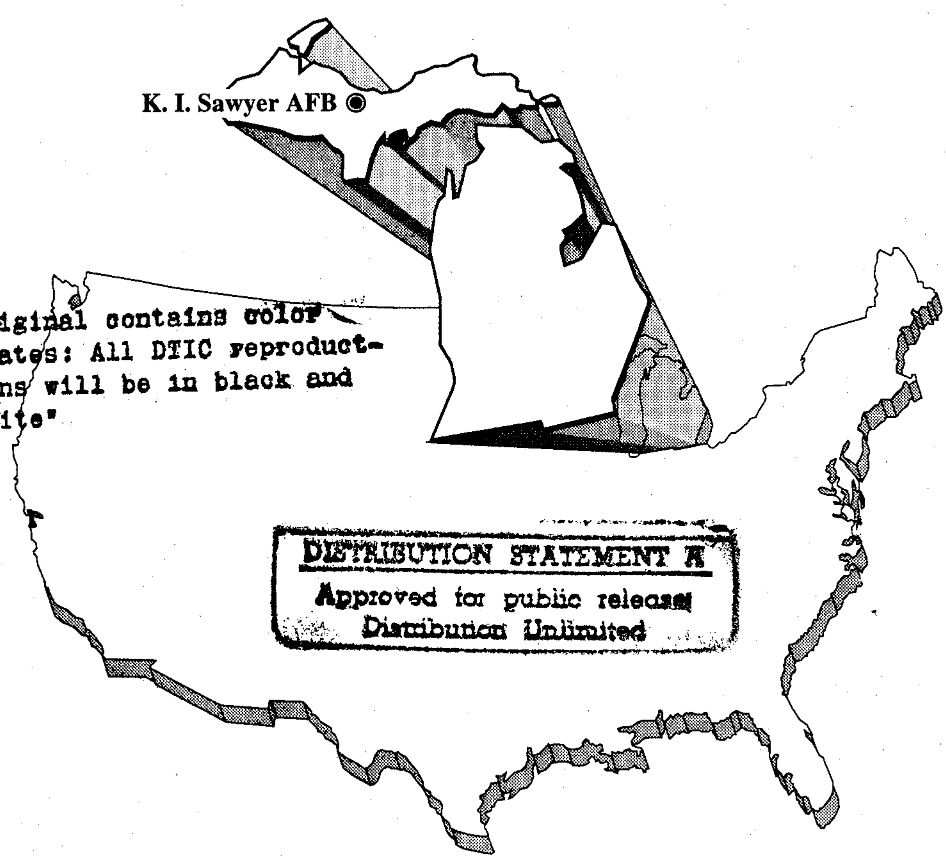
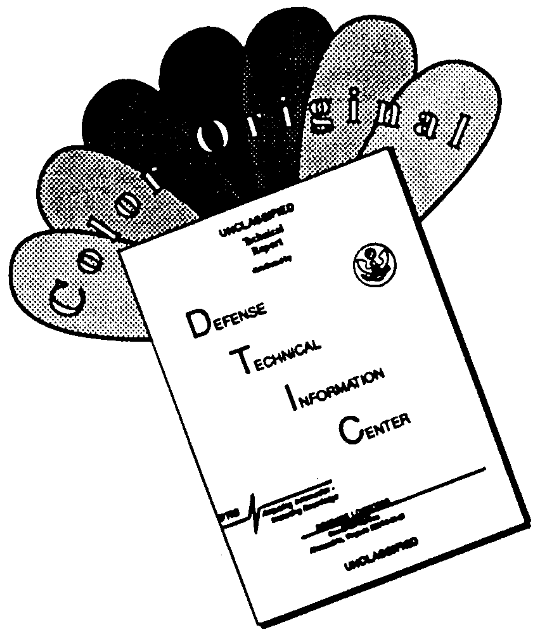
DRAFT
ENVIRONMENTAL IMPACT STATEMENT
November 1995



DISPOSAL OF
K. I. SAWYER AIR FORCE BASE, MICHIGAN

DISCLAIMER NOTICE



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DEPARTMENT OF THE AIR FORCE
HEADQUARTERS UNITED STATES AIR FORCE
WASHINGTON, DC

03 NOV 1995

MEMORANDUM FOR INTERESTED INDIVIDUALS, ORGANIZATIONS, AND PUBLIC AND ACADEMIC REFERENCE LIBRARIES

FROM: HQ USAF/CEV
1260 Air Force Pentagon
Washington, DC 20330-1260

SUBJECT: Draft Environmental Impact Statement (DEIS) for the Disposal and Reuse of K.I. Sawyer Air Force Base (AFB), MI

We are pleased to provide you the DEIS for the disposal and reuse of K.I. Sawyer AFB, Michigan. This document is provided in compliance with the regulations of the President's Council on Environmental Quality.

In response to the Commission on Base Realignment and Closure (Public Law 101-510, Title XXIX), K.I. Sawyer AFB closed on September 30, 1995. This DEIS has been prepared in accordance with the National Environmental Policy Act to analyze the potential environmental consequences of disposal and reuse of the base.

Public review of the DEIS by individuals and organizations will continue through December 26, 1995. A public hearing is scheduled for November 29, 1995 at 7:00 p.m. at the Gwinn High School, 50 W M-35, Gwinn, Michigan.

Libraries should maintain this document in the reference collection for public review. If additional information is needed, or to comment on the DEIS, please contact Mr. William Myers, Chief, Conservation and Planning Directorate, Headquarters Air Force Center for Environmental Excellence, 3207 North Road, Brooks AFB, TX 78235-5363; Phone (210) 536-3860.

Robert M. Wallett

ROBERT M. WALLETT, Lt Colonel, USAF
Director of Environment
Office of The Civil Engineer

Attachment:
DEIS

DRAFT

ENVIRONMENTAL IMPACT STATEMENT

DISPOSAL OF K. I. SAWYER AIR FORCE BASE, MICHIGAN

NOVEMBER 1995

COVER SHEET

DRAFT ENVIRONMENTAL IMPACT STATEMENT
DISPOSAL OF K. I. SAWYER AIR FORCE BASE, MICHIGAN

a. Lead Agency: U.S. Air Force

b. Cooperating Agency: Federal Aviation Administration

c. Proposed Action: Disposal of K. I. Sawyer Air Force Base (AFB), Marquette County, Michigan

d. Inquiries on this document may be directed to: Mr. William A. Myers, Chief of Conservation and Planning Division, HQ AFCEE/ECP, 3207 North Road, Brooks Air Force Base, Texas, 78235-5363, (210) 536-3869

e. Designation: Draft Environmental Impact Statement

f. Abstract: Pursuant to the Defense Base Closure and Realignment Act, K. I. Sawyer AFB was closed in September 1995. This Environmental Impact Statement has been prepared in accordance with the National Environmental Policy Act to analyze the potential environmental consequences of the disposal and reasonable alternatives for reuse of the base. The document includes analyses of community setting, land use and aesthetics, transportation, utilities, hazardous materials and hazardous waste management, geology and soils, water resources, air quality, noise, biological resources, and cultural resources.

Four reuse alternatives were examined: a Proposed Action that features air cargo, regional aircraft maintenance, regional passenger, and general aviation uses of the runway with an industrial component being developed in the military family housing area; an International Wayport Alternative that consists of international passenger, air cargo, and aircraft maintenance uses, as well as regional passenger and general aviation uses, and a large residential area; a Commercial Aviation Alternative that proposes a regional commercial airport with an Upper Peninsula vocational/educational training facility; and a Recreation Alternative that would retain more than 80 percent of the base for public facilities/ recreation land uses. All alternatives include industrial, institutional, commercial, and residential uses. A No-Action Alternative, which would entail no reuse of the base property, was also evaluated.

Potential environmental impacts are increased aircraft and traffic-related noise levels, traffic, and emissions of air pollutants over closure baseline conditions. Roadway improvements may be needed to prevent unacceptable traffic congestion. Increased air pollutant emissions would not affect the region's attainment status. Redevelopment activities could alter drainage patterns and increase erosion, which could be mitigated through proper engineering designs. Wetlands could be lost due to implementation of the reuse alternatives. If avoidance of wetland impacts is not viable, mitigation in the form of replacement, restoration, or enhancement is possible. Cultural resources could be impacted by conveyance to a nonfederal entity. Preservation covenants within disposal documents for Air Force fee-owned land could eliminate or reduce these effects to a nonadverse level. Impacts associated with the Proposed Action would be greater than those associated with the International Wayport, Commercial Aviation, and Recreation alternatives. Remediation of contaminated sites is and will continue to be the responsibility of the Air Force.

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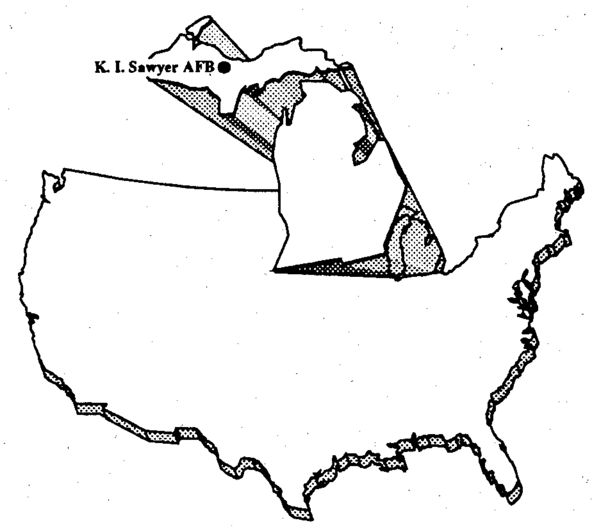


SUMMARY

SUMMARY

PURPOSE OF AND NEED FOR ACTION

K. I. Sawyer Air Force Base (AFB), Michigan, was one of the bases recommended by the 1993 Defense Base Closure and Realignment Commission for closure. The Commission's recommendations were accepted by the President and submitted to Congress on July 2, 1993. As Congress did not disapprove the recommendations in the time given under the Defense Base Closure and Realignment Act of 1990 (Public Law 101-510, Title XXIX), the recommendations have become law. K. I. Sawyer AFB was closed in September 1995.

The Air Force is required to comply with the National Environmental Policy Act (NEPA) in the implementation of the base disposal and reuse. The Air Force must now make a series of interrelated decisions concerning the disposition of base property. This Environmental Impact Statement (EIS) has been prepared to provide information on the potential impacts resulting from disposal and proposed reuse of the base property. The Federal Aviation Administration (FAA) is a cooperating agency in the preparation of this EIS, and it will make decisions on its own and assist the Air Force in making related decisions concerning K. I. Sawyer AFB. Several alternative reuse concepts are studied to identify the range of potential direct and indirect environmental consequences of disposal and reuse.

After completion and consideration of this EIS, the Air Force will prepare decision documents stating the terms and conditions under which the dispositions will be made. These decisions may affect the environment by influencing the nature of the future use of the property.

ALTERNATIVES INCLUDING THE PROPOSED ACTION

The land within the K. I. Sawyer AFB boundary encompasses approximately 4,923 acres, including the airfield, aviation support, industrial, institutional (medical and educational), commercial, residential, public facilities/ recreation, and agricultural (forested) areas. The Air Force has fee simple (unconditional) ownership of approximately 56 percent (2,762 acres) of the lands within the base boundary. The remaining 44 percent (2,161 acres) have been leased (2,001 acres from state of Michigan and county of Marquette) or permitted (160 acres from the Department of the Interior) for Air Force use for a limited duration. The Air Force must terminate or surrender its limited rights to the 44 percent of the base property when the Air Force has fulfilled its legal obligations pursuant to the leases and permits. The remaining 56 percent (Air Force fee-owned property) will be available for disposal or reuse. Because the Air Force decision on whether and how to dispose of the Air Force fee-owned property may influence how the other

44 percent of the base property will be reused, the EIS analyzes the environmental effects of the overall reuse of all of the base property. The Proposed Action and alternatives evaluated in this EIS consider all of the area within the base boundary.

A Proposed Action and four alternatives are assessed in this EIS for the purpose of evaluating potential environmental impacts resulting from the subsequent use of this land. The Air Force has based the Proposed Action on information including the community's reuse concept presented by the K. I. Sawyer Base Conversion Authority. The K. I. Sawyer Base Conversion Authority was formed as a redevelopment authority in September 1993 by the state of Michigan. To encompass the range of possible reuses, the Air Force developed four other alternatives, including the No-Action Alternative, for analysis.

Proposed Action. The Proposed Action centers on support for a mixed use airport with aviation activities including general aviation, regional maintenance and commercial passenger, and air cargo components. Under the Proposed Action a total of 65,088 aircraft operations are expected by 2015. Other major uses include industrial and aviation support. The industrial area would include most of the military family housing and areas west of the runway. The plan also incorporates institutional, commercial, residential, public facilities/recreation, and military uses. The 18-hole golf course would be retained for public use and 422 housing units would be used for permanent residences.

The following alternatives to the Proposed Action are also being considered:

- The **International Wayport Alternative** centers on support for a mixed use airport with international and regional aircraft activities including maintenance, commercial passenger, air cargo, and general aviation components. Under this alternative a total of 100,000 operations would be expected by 2015. Other uses include aviation support, industrial, institutional, commercial, residential, public facilities/recreation, and agriculture. The 18-hole golf course would be retained for public use, and 1,471 housing units would be used for permanent residences. Agricultural uses would consist of timber production.

- The focus of the **Commercial Aviation Alternative** is to provide a regional commercial airport along with an Upper Peninsula vocational/educational training facility including public safety activities. Aircraft operations with this alternative would be 60,900 by 2015. Under this alternative most of the central part of the base would be used for training, with 653 housing units being utilized by students and instructors. Other uses include industrial, commercial, residential, public facilities/recreation, and agricultural (timber production). The 18-hole golf course would be retained for public

use, and 390 housing units would be used for permanent and seasonal resort residences.

- Under the **Recreation Alternative**, there would be no aviation reuse of the airfield. The focus of this alternative would be on restoration and conservation of natural resources for a regional multi-use recreation area. Most of the base would be used for winter sports, such as cross country skiing and snowmobiling, with the hospital being reused as an interpretive center or museum. Other uses include industrial, institutional, commercial, and residential. The 18-hole golf course would be retained for public use, and approximately 112 housing units would be reused for seasonal housing.

- The **No-Action Alternative** would leave the property in caretaker status with no reuse.

Other Land Use Concepts. Five other land use concepts have been identified as being possible components of the Proposed Action and alternatives under consideration. The Michigan Army National Guard (MANG) has expressed interest in portions of K. I. Sawyer AFB as a headquarters for the 107th Combat Engineering Battalion. The MANG activities would include vehicle maintenance, arms proficiency, and driving skills practice. Although no formal proposal has been received, public interest has been expressed for a correctional institution (prison) at K. I. Sawyer AFB as a possible other land use concept. Interest has also been expressed for a sawmill that would process softwoods and would be located at the Weapons Storage Area. The final two other land use concepts consist of waste to energy (solid waste incinerators) facilities that would utilize the base heating plant.

Marquette County Airport. Under the Proposed Action, International Wayport Alternative, and Commercial Aviation Alternative, it is assumed that the aircraft operations at Marquette County Airport would be relocated to K. I. Sawyer AFB. Closure of the airport and reuse are assessed in the EIS for the purpose of evaluating potential environmental impacts. Since there is no aviation component for K. I. Sawyer AFB under the Recreation Alternative or the No-Action Alternative, it is assumed that, under these alternatives, aircraft operations at Marquette County Airport would remain unchanged. This, then, represents the No-Action Alternative for the airport.

SCOPE OF STUDY

The Notice of Intent to prepare an EIS for the disposal of K. I. Sawyer AFB was published in the Federal Register on October 28, 1993. Issues related to the disposal of K. I. Sawyer AFB were identified during an ensuing scoping period. A public scoping meeting was held on May 17, 1994 at the Gwinn High School Auditorium in Gwinn, Michigan. The comments and

concerns expressed at this meeting and in written correspondence received by the Air Force, as well as information from other sources, were used to determine the scope and direction of studies and analyses required to accomplish this EIS.

This EIS discusses the potential environmental impacts associated with the Proposed Action and alternatives, as well as with interim activities (e.g., interim outleases). In order to establish the context in which these environmental impacts may occur, potential changes in population and employment, land use and aesthetics, transportation, and utility services are discussed as reuse-related influencing factors. Issues related to current and future management of hazardous materials and wastes are also discussed. Potential impacts to the physical and natural environment are evaluated for geology and soils, water resources, air quality, noise, biological resources, and cultural resources. These impacts may occur as a direct result of disposal and reuse actions or as an indirect result of changes to the local communities.

The baseline against which the Proposed Action and alternatives are analyzed consists of the conditions projected at base closure in 1995. Although the baseline assumes a closed base, a reference to preclosure conditions is provided in several sections (e.g., air quality and noise) to allow a comparative analysis over time. This will assist the Air Force decision maker and other agencies that may be making decisions relating to disposal and reuse of K. I. Sawyer AFB in understanding potential long-term trends in comparison to historic conditions when the installation was active.

Concurrently with the preparation of the EIS, the Air Force is conducting two other studies in support of the disposal of K. I. Sawyer AFB. The Environmental Baseline Survey (EBS) provides information on the condition of property to be disposed of in compliance with the federal Community Environmental Response Facilitation Act, Public Law 102-42, 42 U.S. Code (U.S.C.) Section 9620(h). An EBS is required by Department of Defense policy before any property can be sold, leased, transferred, or acquired. The Socioeconomic Impact Analysis Study (SIAS) describes the economic impacts expected in the region as a result of the closure, disposal, and reuse of K. I. Sawyer AFB. This document, although not required by NEPA, will assist the local community in planning for the transition of the base from military to civilian use. The EIS uses population and employment projections from the SIAS to support the analysis of potential environmental impacts to biophysical resources.

SUMMARY OF ENVIRONMENTAL IMPACTS

This EIS considers environmental impacts of the Air Force's disposal of the installation and portrays a variety of potential land uses to cover reasonable future uses of the property and facilities by others. Alternative scenarios,

including the general approach of the most likely community's proposed plan, were used to group reasonable land uses and to examine the reasonably foreseeable environmental effects of likely reuse of K. I. Sawyer AFB.

Potential environmental impacts of the Proposed Action and reasonable alternatives are briefly described below. Reuse-related factors include projections of the reuse activities that would likely influence the biophysical environment, including ground disturbance, socioeconomic factors, and infrastructure demands, and are summarized in Table S-1. The employment and population trends are depicted in Figures S-1 and S-2. Potential impacts of the Proposed Action and reasonable alternatives over the 20-year study period are summarized in Table S-2. Impacts for air quality are summarized over a 10-year period due to the speculative nature of projecting pollution concentrations far in the future.

Mitigations and Pollution Prevention. Options for mitigating potential environmental impacts that might result from the Air Force disposing of property or from the implementation of the Proposed Action or alternatives by property recipients are presented and discussed. Since most potential environmental impacts would result directly from the reuse by others, the Air Force would not typically be responsible for implementing such mitigations. Responsibility for these suggested mitigations, therefore, would be borne primarily by future property recipients or local governmental agencies. In a few exceptional cases (e.g., wetlands or cultural resources protection), the Air Force could impose mitigation requirements on property recipients by lease restrictions or deed covenants. Mitigation suggestions for affected resource areas, where appropriate, are summarized along with the environmental impacts of the Proposed Action and alternatives in Table S-2. However, the remediation of contamination sites under the Installation Restoration Program (IRP) and other applicable regulatory programs is and will continue to be the responsibility of the Air Force.

PROPOSED ACTION

Local Community. Redevelopment of the base property under the Proposed Action would result in an increase in employment and population in the Region of Influence (ROI), which consists of the counties of Marquette and Delta. Most of the increases would affect the townships of Forsyth, Sands, and West Branch and the cities of Marquette, Ishpeming, and Negaunee. Reuse activities would increase employment levels by approximately 9,853 direct jobs and 7,450 secondary jobs by 2015, resulting in a total ROI employment of 81,368 in 2015. The Proposed Action would increase ROI population by about 10,483 persons, or 9 percent over the No-Action Alternative by 2015.

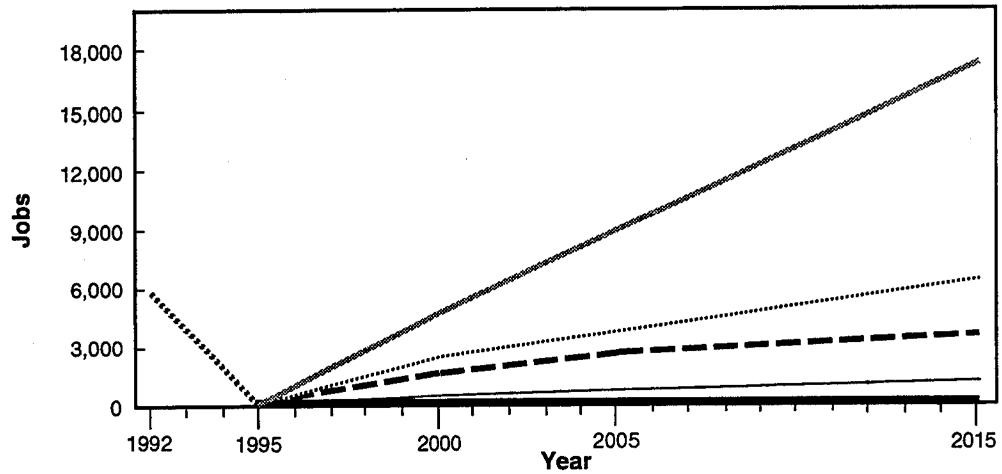
Table S-1. Summary of Reuse-Related Influencing Factors

	Proposed Action			International Waypoint Alternative			Commercial Aviation Alternative			Recreation Alternative			No-Action Alternative[a]
Factor	2000	2005	2015	2000	2005	2015	2000	2005	2015	2000	2005	2015	
Ground disturbance (acres by phase)	171	170	340	159	47	174	237	6	16	99	98	4	0
Aircraft operations (annual)	46,188	52,138	65,088	45,000	72,500	100,000	42,300	48,100	60,900	0	0	0	0
Direct employment	2,668	5,064	9,853	1,489	2,336	3,844	1,035	1,650	2,176	355	581	806	50
Secondary employment	1,986	3,807	7,450	959	1,531	2,528	703	1,093	1,366	154	248	370	13
Population increase	2,528	5,014	10,483	1,411	2,309	4,056	995	1,645	2,301	351	592	863	0
Traffic (total daily trips)	8,750	17,100	33,800	14,200	20,100	30,250	7,150	12,750	20,550	2,450	4,300	6,050	150
Increase in water demand (MGD)	0.96	1.88	3.79	0.72	1.00	1.48	0.35	0.64	1.04	0.10	0.17	0.27	0
Increase in wastewater production (MGD)	0.47	0.92	1.88	0.60	0.84	1.24	0.28	0.51	0.86	0.07	0.13	0.21	0
Increase in solid waste (tons/day)	11.56	22.04	44.08	14.10	19.94	29.97	6.69	11.83	19.38	1.85	3.46	5.71	0
Increase in electricity demand (MWH/day)	55.06	103.90	205.16	79.41	107.72	153.84	36.04	64.51	105.61	7.99	15.62	25.59	0
Increase in natural gas demand (MMCF/day)	0.60	1.16	2.33	0.72	0.99	1.46	0.39	0.68	1.08	0.88	0.98	1.09	0

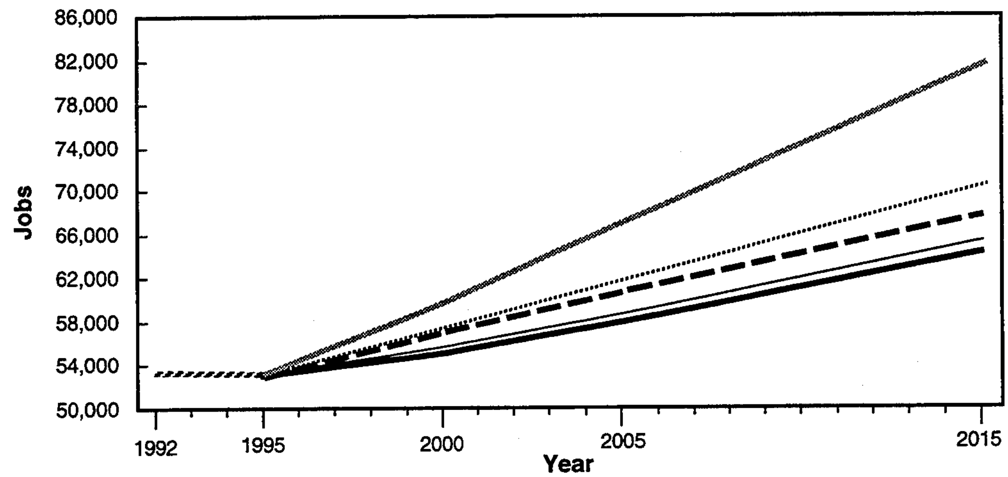
Notes: Values shown represent change from projected No-Action Alternative conditions in each year as a result of implementing that alternative.
(a) The No-Action Alternative values summarize influencing factors relative to the projected closure conditions for each period of analysis.
MGD = million gallons/day
MMCF = million cubic feet
MWH = megawatt-hours

ALTERNATIVE	1995 (a)	2000	2005	2015
Proposed Action	63	4,654	8,871	17,303
International Wayport Alternative	63	2,448	3,867	6,372
Commercial Aviation Alternative	63	1,738	2,743	3,542
Recreation Alternative	63	509	829	1,176

Reuse-Related Employment Effects (b)



Reuse-Related Employment Effects (b)



Total Region of Influence (ROI) Employment Including Reuse Effects

EXPLANATION

- Preclosure
- Proposed Action
- International Wayport Alternative
- Commercial Aviation Alternative
- Recreation Alternative
- No-Action Alternative

(a) The 1995 values represent total base-related employment under the closure baseline.

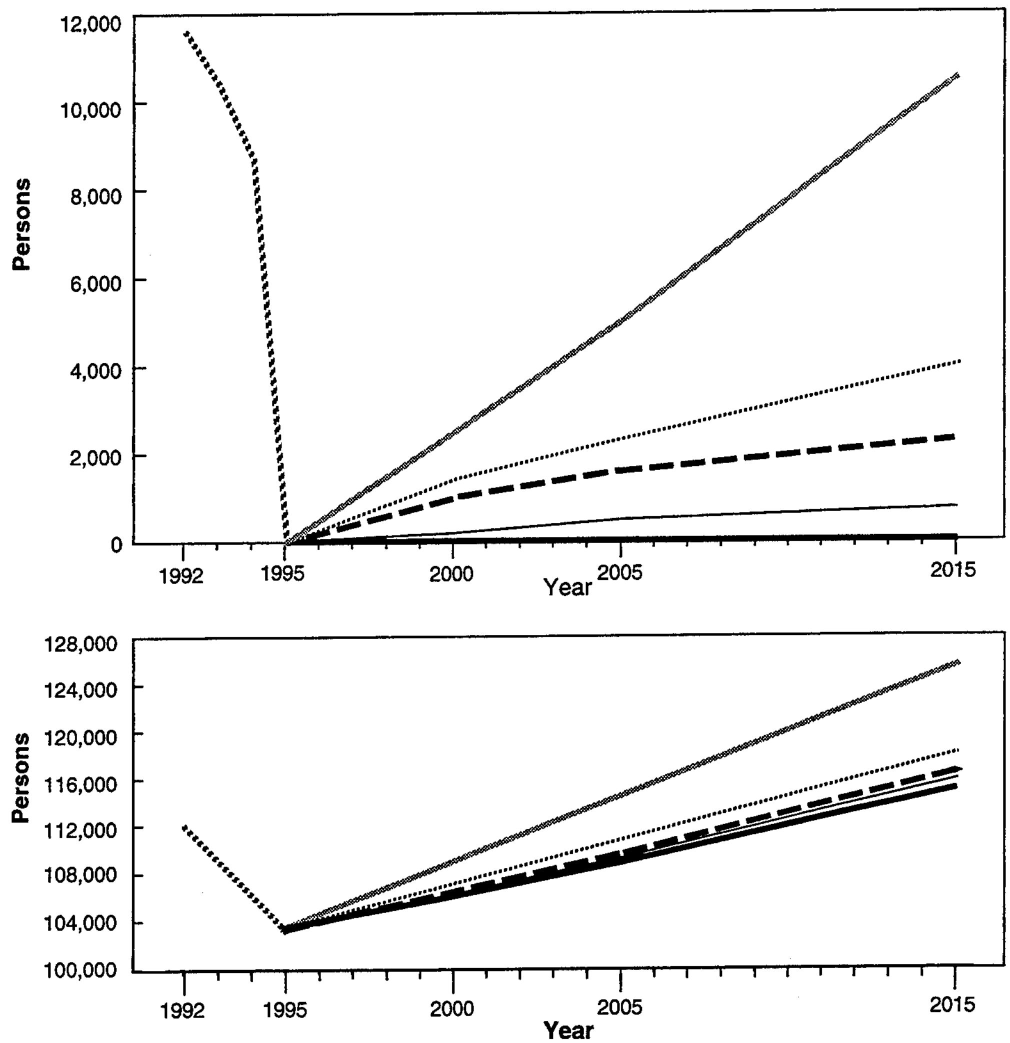
(b) Employment effects include both direct and secondary employment and represent the change in employment relative to the No-Action Alternative.

Reuse-Related Employment Effects

Figure S-1

ALTERNATIVE	1995	2000	2005	2015
Proposed Action	0	2,528	5,014	10,483
International Wayport Alternative	0	1,411	2,309	4,056
Commercial Aviation Alternative	0	995	1,645	2,301
Recreation Alternative	0	351	592	863

Reuse-Related Population Effects



Reuse-Related Population Effects

Total ROI Population Including Reuse

EXPLANATION

- Preclosure
- Proposed Action
- International Wayport Alternative
- Commercial Aviation Alternative
- Recreation Alternative
- No-Action Alternative

Note: 1995 represents closure conditions. Reuse-related population effects are the persons that would move into the ROI solely as a result of reuse.

Reuse-Related Population Effects

Figure S-2

Table S-2. Summary of Substantial Adverse Environmental Impacts and Suggested Mitigations for the Proposed Action and Reasonable Reuse Alternatives
Page 1 of 9

Resource Category	Proposed Action	International Waypoint Alternative	Commercial Aviation Alternative	Recreation Alternative	No-Action Alternative
Local Community					
• Land Use and Aesthetics	• **Impacts:** Visual quality could be impacted by proposed industrial development	• **Impacts:** No impacts	• **Impacts:** No impacts	• **Impacts:** No impacts	• **Impacts:** No impacts
	• **Mitigation:** Use of landscape screening	• **Mitigation:** No mitigation required	• **Mitigation:** No mitigation required	• **Mitigation:** No mitigation required	• **Mitigation:** No mitigation required
• Transportation (Surface)	• **Impacts:** Increase of 33,800 daily vehicular trips. Three new access points. Segments of CR 553 could drop to unacceptable Levels of Service	• **Impacts:** Increase of 30,250 daily vehicular trips. One new access point. CR 462 could drop to unacceptable Levels of Service	• **Impacts:** Increase of 20,550 daily vehicular trips. No new access points. No road segments would drop to unacceptable Levels of Service	• **Impacts:** Increase of 6,050 daily vehicular trips. No new access points. No road segments would drop to unacceptable Levels of Service	• **Impacts:** No impacts
	• **Mitigation:** Widening of roads or providing intersection channelization and signalization would increase Level of Service to acceptable conditions	• **Mitigation:** Same as Proposed Action	• **Mitigation:** No mitigation required	• **Mitigation:** No mitigation required	• **Mitigation:** No mitigation required
• Transportation (Airspace)	• **Impacts:** No Impacts	• **Impacts:** No Impacts	• **Impacts:** No Impacts	• **Impacts:** No Impacts	• **Impacts:** No aircraft operations. No change in regional airspace
	• **Mitigation:** No mitigation required	• **Mitigation:** No mitigation required	• **Mitigation:** No mitigation required	• **Mitigation:** No mitigation required	• **Mitigation:** No mitigation required

Note: Impacts are based on the changes from closure baseline conditions, which are projected to occur as a result of implementing that alternative.
CR = County Road

Table S-2. Summary of Substantial Adverse Environmental Impacts and Suggested Mitigations for the Proposed Action and Reasonable Reuse Alternatives
Page 2 of 9

Resource Category	Proposed Action	International Wayport Alternative	Commercial Aviation Alternative	Recreation Alternative	No-Action Alternative
Local Community (Continued) • Utilities	• **Impacts:** No impacts • **Mitigation:** No mitigation required	• **Impacts:** No impacts • **Mitigation:** No mitigation required	• **Impacts:** No impacts • **Mitigation:** No mitigation required	• **Impacts:** No impacts • **Mitigation:** No mitigation required	• **Impacts:** No change in base-related utility use • **Mitigation:** No mitigation required
Hazardous Materials and Hazardous Waste Management • Hazardous Materials Management	• **Impacts:** Quantities of various materials used • **Mitigation:** Follow pollution prevention practices	• **Impacts:** Same as Proposed Action • **Mitigation:** Same as Proposed Action	• **Impacts:** Same as Proposed Action • **Mitigation:** Same as Proposed Action	• **Impacts:** Same as Proposed Action • **Mitigation:** Same as Proposed Action	• **Impacts:** No change in types and quantities used • **Mitigation:** No mitigation required
• Hazardous Waste Management	• **Impacts:** Quantities of various wastes generated • **Mitigation:** Follow waste minimization and pollution prevention practices Follow recommendations of Bi-National Program to Restore and Protect the Lake Superior Basin	• **Impacts:** Same as Proposed Action • **Mitigation:** Same as Proposed Action	• **Impacts:** Same as Proposed Action • **Mitigation:** Same as Proposed Action	• **Impacts:** Same as Proposed Action • **Mitigation:** Same as Proposed Action	• **Impacts:** No change in quantities generated. • **Mitigation:** No mitigation required

Note: Impacts are based on the changes from closure baseline conditions, which are projected to occur as a result of implementing that alternative.

Table S-2. Summary of Substantial Adverse Environmental Impacts and Suggested Mitigations for the Proposed Action and Reasonable Reuse Alternatives
Page 3 of 9

Resource Category	Proposed Action	International Waypoint Alternative	Commercial Aviation Alternative	Recreation Alternative	No-Action Alternative
Hazardous Materials and Hazardous Waste Management (Continued)					
• Installation Restoration Program	• **Impacts:** No adverse environmental impacts; however possible redevelopment delays and land use restrictions due to remediation	• **Impacts:** Same as Proposed Action	• **Impacts:** Same as Proposed Action	• **Impacts:** Same as Proposed Action	• **Impacts:** IRP remediation activities completed or continued as required
	• **Mitigation:** Coordinate IRP and construction activities Reuse some sites as open space, greenbelts, or parks	• **Mitigation:** Same as Proposed Action	• **Mitigation:** Same as Proposed Action	• **Mitigation:** Same as Proposed Action	• **Mitigation:** No mitigation required
• Storage Tanks	• **Impacts:** No impacts	• **Impacts:** No impacts	• **Impacts:** No impacts	• **Impacts:** No impacts	• **Impacts:** No impacts
	• **Mitigation:** No mitigation required	• **Mitigation:** No mitigation required	• **Mitigation:** No mitigation required	• **Mitigation:** No mitigation required	• **Mitigation:** No mitigation required
• Asbestos	• **Impacts:** Increase in renovation and demolition of existing structures that contain asbestos	• **Impacts:** Same as Proposed Action	• **Impacts:** Same as Proposed Action	• **Impacts:** Same as Proposed Action	• **Impacts:** No impact with management of asbestos in accordance with Air Force policy

Note: Impacts are based on the changes from closure baseline conditions, which are projected to occur as a result of implementing that alternative.
IRP = Installation Restoration Program

Table S-2. Summary of Substantial Adverse Environmental Impacts and Suggested Mitigations for the Proposed Action and Reasonable Reuse Alternatives

Resource Category	Proposed Action	International Wayport Alternative	Commercial Aviation Alternative	Recreation Alternative	No-Action Alternative
Hazardous Materials and Hazardous Waste Management (Continued)					
• Asbestos (Continued)	• **Mitigation:** None needed if coordination of asbestos removal or management during renovation and demolition activities is accomplished. Advise recipients of potential hazards	• **Mitigation:** Same as Proposed Action	• **Mitigation:** Same as Proposed Action	• **Mitigation:** Same as Proposed Action	• **Mitigation:** No mitigation required
• Pesticide Usage	• **Impacts:** Use associated with proposed reuse	• **Impacts:** Same as Proposed Action	• **Impacts:** Same as Proposed Action	• **Impacts:** Same as Proposed Action	• **Impacts:** No change in usage or management practices
	• **Mitigation:** No mitigation required	• **Mitigation:** No mitigation required	• **Mitigation:** No mitigation required	• **Mitigation:** No mitigation required	• **Mitigation:** No mitigation required
• Polychlorinated Biphenyls	• **Impacts:** No impact. All regulated PCB equipment has been removed	• **Impacts:** Same as Proposed Action	• **Impacts:** Same as Proposed Action	• **Impacts:** Same as Proposed Action	• **Impacts:** Same as Proposed Action
	• **Mitigation:** No mitigation required	• **Mitigation:** No mitigation required	• **Mitigation:** No mitigation required	• **Mitigation:** No mitigation required	• **Mitigation:** No mitigation required

Note: Impacts are based on the changes from closure baseline conditions, which are projected to occur as a result of implementing that alternative.
PCB = polychlorinated biphenyls

Table S-2. Summary of Substantial Adverse Environmental Impacts and Suggested Mitigations for the Proposed Action and Reasonable Reuse Alternatives

Resource Category	Proposed Action	International Wayport Alternative	Commercial Aviation Alternative	Recreation Alternative	No-Action Alternative
Hazardous Materials and Hazardous Waste Management (Continued)					
• Radon	• **Impacts:** No impact. Current levels below 4 pCi/l	• **Impacts:** Same as Proposed Action	• **Impacts:** Same as Proposed Action	• **Impacts:** Same as Proposed Action	• **Impacts:** Same as Proposed Action
	• **Mitigation:** No mitigation required	• **Mitigation:** No mitigation required	• **Mitigation:** No mitigation required	• **Mitigation:** No mitigation required	• **Mitigation:** No mitigation required
• Medical/Biohazardous Waste	• **Impacts:** Small amounts generated with clinic	• **Impacts:** Same as Proposed Action	• **Impacts:** Small amounts generated with first aid training	• **Impacts:** No impact. None generated	• **Impacts:** No impact. None generated
	• **Mitigation:** No mitigation required	• **Mitigation:** No mitigation required	• **Mitigation:** No mitigation required	• **Mitigation:** No mitigation required	• **Mitigation:** No mitigation required
• Ordnance	• **Impacts:** No impact. Ranges cleared prior to disposal. No impact from reuse of the small arms firing range if properly maintained	• **Impacts:** Same as Proposed Action	• **Impacts:** Same as Proposed Action	• **Impacts:** No impact. Ranges cleared prior to disposal	• **Impacts:** No impact
	• **Mitigation:** No mitigation required	• **Mitigation:** No mitigation required	• **Mitigation:** No mitigation required	• **Mitigation:** No mitigation required	• **Mitigation:** No mitigation required

Note: Impacts are based on the changes from closure baseline conditions, which are projected to occur as a result of implementing that alternative.
pCi/l = picocuries per liter

Table S-2. Summary of Substantial Adverse Environmental Impacts and Suggested Mitigations for the Proposed Action and Reasonable Reuse Alternatives
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Resource Category	Proposed Action	International Wayport Alternative	Commercial Aviation Alternative	Recreation Alternative	No-Action Alternative
Hazardous Materials and Hazardous Waste Management (Continued) • Lead-Based Paint	• **Impacts:** Potential exposure to lead-based paint in facilities constructed prior to or during 1978	• **Impacts:** Same as Proposed Action	• **Impacts:** Same as Proposed Action	• **Impacts:** Same as Proposed Action	• **Impacts:** No impact if managed in accordance with Air Force policy
	• **Mitigation:** Advise recipients of potential hazard. No mitigation required if coordination of lead-based paint removal is in conjunction with construction and renovation activities	• **Mitigation:** Same as Proposed Action	• **Mitigation:** Same as Proposed Action	• **Mitigation:** Same as Proposed Action	• **Mitigation:** No mitigation required
Natural Environment • Geology and Soils	• **Impacts:** Erosion effects from 681 acres of ground disturbance	• **Impacts:** Minor erosion effects from 380 acres of ground disturbance	• **Impacts:** Minor erosion effects from 259 acres of ground disturbance	• **Impacts:** Minor erosion effects from 201 acres of ground disturbance	• **Impacts:** No impact
	• **Mitigation:** Use of cover and limiting exposure time would minimize erosion effects	• **Mitigation:** Same as Proposed Action	• **Mitigation:** Same as Proposed Action	• **Mitigation:** Same as Proposed Action	• **Mitigation:** No mitigation required

Note: Impacts are based on the changes from closure baseline conditions, which are projected to occur as a result of implementing that alternative.

Table S-2. Summary of Substantial Adverse Environmental Impacts and Suggested Mitigations for the Proposed Action and Reasonable Reuse Alternatives
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Resource Category	Proposed Action	International Wayport Alternative	Commercial Aviation Alternative	Recreation Alternative	No-Action Alternative
Natural Environment (Continued)					
• Water Resources	• **Impacts:**	• **Impacts:**	• **Impacts:**	• **Impacts:**	• **Impacts:**
	Surface water runoff from 681 acres of ground disturbance	Surface water runoff from 380 acres of ground disturbance	Surface water runoff from 259 acres of ground disturbance	Surface water runoff from 201 acres of ground disturbance	No impact
	Reuse of base wells in housing may cause lowering of water levels in lakes east of the base	Same as Proposed Action	Same as Proposed Action	Same as Proposed Action	
	• **Mitigation:**	• **Mitigation:**	• **Mitigation:**	• **Mitigation:**	• **Mitigation:**
	Control of runoff, minimizing exposure time and area, and use of landscaping could reduce effects of runoff on water quality. Implementation of a wellhead protection program	Same as Proposed Action	Same as Proposed Action	Same as Proposed Action	No mitigation required
	To mitigate lowering lakes, find alternate water supplies or reduce the yield of water from existing wells to an acceptable level				
	Follow recommendations of Bi-National Program to Restore and Protect the Lake Superior Basin				

Note: Impacts are based on the changes from closure baseline conditions, which are projected to occur as a result of implementing that alternative.

Table S-2. Summary of Substantial Adverse Environmental Impacts and Suggested Mitigations for the Proposed Action and Reasonable Reuse Alternatives
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Resource Category	Proposed Action	International Wayport Alternative	Commercial Aviation Alternative	Recreation Alternative	No-Action Alternative
Natural Environment (Continued)					
• Air Quality	• **Impacts:** Regional emissions will not exceed NAAQS or affect attainment status, or otherwise cause substantial air quality degradation	• **Impacts:** Same as Proposed Action	• **Impacts:** Same as Proposed Action	• **Impacts:** Same as Proposed Action	• **Impacts:** No impact
	• **Mitigation:** No mitigation required	• **Mitigation:** No mitigation required	• **Mitigation:** No mitigation required	• **Mitigation:** No mitigation required	• **Mitigation:** No mitigation required
• Noise	• **Impacts:** 424 acres and no residents exposed to DNL 65 dB or greater due to aircraft operations in 2015. 184 additional residents exposed to DNL 65 dB or greater due to surface traffic noise	• **Impacts:** 948 acres and no residents exposed to DNL 65 dB or greater due to aircraft operations in 2015. 136 additional residents exposed to DNL 65 dB or greater due to surface traffic noise	• **Impacts:** 125 acres and no residents exposed to DNL 65 dB or greater due to aircraft operations in 2015. 112 additional residents exposed to DNL 65 dB or greater due to surface traffic noise	• **Impacts:** 39 additional residents exposed to DNL 65 dB or greater due to surface traffic noise	• **Impacts:** No impact
	• **Mitigation:** Change takeoff climbout and landing procedures to minimize aircraft noise. Restrict development in high noise areas. Manage aircraft activities to reduce noise levels Increase sound insulation in existing buildings to minimize traffic noise	• **Mitigation:** Same as Proposed Action	• **Mitigation:** Same as Proposed Action	• **Mitigation:** Increase sound insulation in existing buildings to minimize traffic noise	• **Mitigation:** No mitigation required

Note: Impacts are based on the changes from closure baseline conditions, which are projected to occur as a result of implementing that alternative.
dB = decibel
DNL = day-night average sound level
NAAQS = National Ambient Air Quality Standards

Table S-2. Summary of Substantial Adverse Environmental Impacts and Suggested Mitigations for the Proposed Action and Reasonable Reuse Alternatives

Resource Category	Proposed Action	International Wayport Alternative	Commercial Aviation Alternative	Recreation Alternative	No-Action Alternative
Natural Environment (Continued)					
• Biological Resources	• **Impacts:** Potential impact to 0 to 2.5 acres of wetlands[a] No impacts to threatened or endangered species	• **Impacts:** Potential impact to 2 to 8.5 acres of wetlands[b] No impacts to threatened or endangered species	• **Impacts:** Potential impact to 0 to 9.5 acres of wetlands[a] No impacts to threatened or endangered species	• **Impacts:** Potential impact to 0 to 2.5 acres of wetlands[a] No impacts to threatened or endangered species	• **Impacts:** Beneficial impacts may occur over time due to reduced human activity
	• **Mitigation:** Wetlands mitigation could include avoidance through facility design; replacement, enhancement of wetland habitat; or control of construction-related erosion into nearby wetlands. Development of soil erosion and sedimentation control plan in accordance with applicable regulations	• **Mitigation:** Same as Proposed Action	• **Mitigation:** Same as Proposed Action	• **Mitigation:** Same as Proposed Action	• **Mitigation:** No mitigation required
• Cultural Resources	• **Impacts:** Potential adverse effects to two prehistoric sites eligible for listing in the NRHP	• **Impacts:** Same as Proposed Action	• **Impacts:** Same as Proposed Action	• **Impacts:** Same as Proposed Action	• **Impacts:** No impact
	• **Mitigation:** Historic properties on Air Force fee-owned property may be conveyed to nonfederal owners with preservation covenants. Consult with SHPO and Advisory Council on Historic Preservation in development and implementation of mitigation strategies	• **Mitigation:** Same as Proposed Action	• **Mitigation:** Same as Proposed Action	• **Mitigation:** Same as Proposed Action	• **Mitigation:** No mitigation required

Notes: Impacts are based on the changes from closure baseline conditions, which are projected to occur as a result of implementing that alternative.
(a) Likely wetland impact is 0 acres.
(b) Likely wetland impact is 2 acres.
NRHP = National Register of Historic Places
SHPO = State Historic Preservation Officer

Noticeable changes to on-base land uses would occur due to civilian redevelopment. Proposed on-base land uses would generally be compatible with existing land uses surrounding the base, except for the proposed industrial area on the east side of the base. This proposed land use should be visually buffered from the off-base residential areas to the east. The aviation reuse of the airfield would be similar to preclosure conditions. The comprehensive plans of the local (affected) communities may require revision. The zoning ordinances of the local communities may also require revision except for those administered by Sands Township, which are consistent with the proposed land uses. Under the Proposed Action the high visual sensitivity areas along Silver Lead Creek and the golf course would remain unchanged from the closure baseline.

The Proposed Action would incorporate three new entry points to improve access to the west side of the base for the proposed new airport terminal and industrial areas. Traffic associated with the Proposed Action would degrade County Road (CR) 553 from CR 480 to Southgate Drive to Level of Service (LOS) F by 2015. Implementation of roadway improvements could improve the LOS to meet transportation planning criteria. No airspace conflicts or air transportation impacts are expected under the Proposed Action.

Utility consumption associated with the Proposed Action would represent an increase to the ROI demand and could be accommodated by existing and future systems capacities. However, the wastewater treatment plant (WWTP) at K. I. Sawyer AFB may require modification to operate efficiently under reduced flows. The plant operator would continue to monitor effluents from the WWTP under the conditions of the discharge permit and make any necessary modification to ensure regulatory requirements are met.

Hazardous Materials and Hazardous Waste Management. The quantities of hazardous materials and waste used and generated under the Proposed Action are expected to be greater than under closure conditions and similar to preclosure conditions. The responsibility for managing hazardous materials and wastes would shift from a single user to multiple, independent users. Remediation of solid waste management unit (SWMU) and Area of Concern (AOC) sites would not be affected by reuse; however, site remediation, if required, could result in redevelopment delays or lease restrictions.

Reuse activities are not expected to affect remediation under the IRP, which is proceeding according to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) regulations. The Restoration Advisory Board will continue to review and provide comments on proposed remedial actions and act as the liaison between the local community and the Base Realignment and Closure (BRAC) Cleanup Team during environmental restoration. However, redevelopment of some properties may be delayed or

land use restrictions may be required due to the extent and type of site contamination and by current and future IRP remediation activities. Based on the results of IRP investigations, the Air Force may, where appropriate, place limits on land reuse through deed restrictions on conveyances and use restrictions on leases. Prior to property disposal, existing underground storage tanks (USTs) not in conformance with current regulations or not required for reuse would be deactivated and removed in accordance with applicable regulations. Unused aboveground storage tanks would be purged and assessed, and oil/water separators that would not be reused would be closed in accordance with applicable regulations. New storage tanks required for reuse would be subject to all federal, state, and local regulations. All polychlorinated biphenyl (PCB) equipment and PCB-contaminated equipment has been removed from the base. All ordnance associated with the explosive ordnance disposal range and active and former grenade ranges, and spent bullets associated with the small arms firing range will be cleared prior to disposal. These sites and the former skeet range will be investigated to determine the presence or absence of contamination. If contamination is found, disposal of this property may be delayed by site remediation. The small arms firing range would continue to be used as a firing range in accordance with applicable regulations.

Asbestos-containing material (ACM) in such a condition that it poses a health risk will be abated prior to property disposal. Proper management of ACM remaining in existing buildings will minimize the potential risk to human health and the environment. Demolition or renovation of structures with ACM would be subject to applicable regulations and National Emissions Standards for Hazardous Air Pollutants. Increased pesticide usage because of reuse activities would be subject to the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) and state guidelines. Radon levels at K. I. Sawyer AFB are below the U.S. Environmental Protection Agency (EPA) recommended mitigation level of 4 picocuries per liter. Medical/ biohazardous waste generated under this alternative would be disposed of in accordance with the Michigan Medical Waste Management Act. Recipients of facilities constructed prior to or during 1978 would be notified that lead-based paint may exist on the premises. Demolition or renovation activities for facilities containing lead-based paint would be subject to all applicable regulations.

Natural Environment. The Proposed Action would result in minor effects on geology, soils, and water resources from ground disturbance associated with facility construction, renovation, and demolition, and infrastructure improvements. There is sufficient water supply from sources in the ROI. However, the use of two on-base wells at K. I. Sawyer AFB may be lowering the water levels at nearby lakes. If the wells are determined to be the cause of the lowering lake levels, alternate water supplies or reducing the yield from the existing wells may need to be investigated. Air pollutant emissions generated by the Proposed Action would be greater than under

the No-Action Alternative, but would remain below federal and state standards.

Aircraft noise from the Proposed Action aviation activities would result in increased noise levels compared to closure conditions. However, by 2015 there would be 26,665 fewer acres exposed to a day-night average sound level (DNL) of 65 decibels (dB) or greater than under preclosure conditions. The number of people living in areas exposed to surface traffic noise levels of DNL 65 dB or greater would be 35 percent (184 persons) more than under the No-Action Alternative. Proper land use planning could reduce the effects of surface traffic noise.

Effects on biological resources would be minor under the Proposed Action. Development could result in impacts to 0 to 2.5 acres of wetlands in the west and central parts of the base. Minimal impacts are expected, however, as ample opportunities exist for avoidance. Impacts to wetlands could be mitigated through avoidance or replacement. No federally or state-listed threatened and endangered species are expected to be impacted by the Proposed Action. Disposal activities could affect historic properties that are potentially eligible for listing in the National Register of Historic Places (NRHP). However, preservation covenants could be placed in the transfer documents for Air Force fee-owned land to reduce impacts associated with conveyance to a nonfederal entity.

Environmental Justice. Local community resources (i.e., community setting, land use and aesthetics, transportation, and utilities) were identified as influencing factors only and would not disproportionately affect low-income and minority populations. Under the Proposed Action there would be no effects to low-income and minority populations analyzed for Environmental Justice for the following natural resources: hazardous materials and hazardous waste management, geology and soils, water resources, air quality, aircraft-related noise, biological resources, and cultural resources.

Surface traffic noise impacts previously described in this section could impact low-income and minority populations located in an area southwest of the base along State Highway 35 near the community of Gwinn.

INTERNATIONAL WAYPORT ALTERNATIVE

Local Community. Redevelopment of the base property under the International Wayport Alternative would result in an increase in employment and population in the ROI, compared to the No-Action Alternative. Reuse activities would increase employment levels by approximately 3,844 direct jobs and 2,528 secondary jobs by 2015, resulting in a total ROI employment of 70,437 in 2015. The International Wayport Alternative would increase ROI population by about 4,056 persons, or 4 percent over the No-Action Alternative by 2015.

Noticeable changes in on-base land uses would occur due to civilian redevelopment. Proposed on-base land uses would generally be compatible with existing land uses surrounding the base, and the aviation reuse of the airfield would be similar to preclosure conditions. The comprehensive plans of the local communities may require revision. The zoning ordinances of the local communities may also require revision except for those administered by Sands Township, which are consistent with the proposed land uses. Under the International Waypoint Alternative the high visual sensitivity areas along Silver Lead Creek and the golf course would remain unchanged from the closure baseline.

The International Wayport Alternative would incorporate one new entry point to improve access to the west side of the base for the proposed new airport terminal. Traffic associated with the International Wayport Alternative would degrade CR 462 between the K. I. Sawyer AFB Main Gate and CR 553 to LOS F by 2015. Implementation of roadway improvements could improve the LOS to meet transportation planning criteria. No airspace conflicts or air transportation impacts are expected under the International Wayport Alternative.

Utility consumption associated with the International Wayport Alternative would be less than under the Proposed Action and could be accommodated by existing and future systems capacities. Impacts to the WWTP would be similar to those under the Proposed Action.

Hazardous Materials and Hazardous Waste Management. The quantities of hazardous materials and waste used and generated under the International Wayport Alternative are expected to be greater than closure conditions and similar to those under the Proposed Action. SWMU, AOC, and IRP site remediation could cause some delays in redevelopment or require some land use restrictions. Other aspects of hazardous materials and waste management associated with this alternative would be similar to those discussed under the Proposed Action.

Natural Environment. The International Wayport Alternative would result in minor effects on geology, soils, and water resources from ground disturbance associated with facility construction, renovation, and demolition, and infrastructure improvements. There is sufficient water supply from sources in the ROI. However, the use of two on-base wells at K. I. Sawyer AFB may be lowering the water levels at nearby lakes. If the wells are determined to be the cause of the lowering lake levels, alternate water supplies or reducing the yield from the existing wells may need to be investigated. Air pollutant emissions generated by the International Wayport Alternative would be below federal and state standards.

Aircraft noise associated with the International Wayport Alternative would be greater than under the Proposed Action. However, by 2015 there would

be 26,141 fewer acres exposed to DNL 65 dB or greater than under preclosure conditions. The number of people living in areas exposed to surface traffic noise levels of DNL 65 dB or greater would be 26 percent (136 persons) more than under the No-Action Alternative. Proper land use planning could reduce the effects of surface traffic noise.

Effects on biological resources are minimal under the International Wayport Alternative. Development could result in impacts to 2 to 8.5 acres of wetlands in the west and central parts of the base. Minimal impacts are expected, however, as ample opportunities exist for avoidance. Impacts to wetlands could be mitigated through avoidance or replacement. No federally or state-listed threatened and endangered species are expected to be impacted by the International Wayport Alternative. Disposal activities could affect historic properties that are potentially eligible for listing in the NRHP. However, preservation covenants could be placed in the transfer documents for Air Force fee-owned land to reduce impacts associated with conveyance to a nonfederal entity.

Environmental Justice. Environmental Justice impacts would be similar to those described under the Proposed Action except that surface traffic noise impacts would affect less people in low-income and minority population areas.

COMMERCIAL AVIATION ALTERNATIVE

Local Community. Redevelopment of the base property under this alternative would result in an increase in employment and population in the ROI. Reuse activities would increase employment levels by approximately 2,176 direct jobs and 1,366 secondary jobs by 2015, resulting in a total ROI employment of 67,607 in 2015. The Commercial Aviation Alternative would increase ROI population by approximately 2,301 persons, or 2 percent over the No-Action Alternative by 2015.

Noticeable changes in on-base land uses would occur due to civilian redevelopment. Proposed on-base land uses would generally be compatible with each other and with off-base land uses. The aviation reuse of the airfield would be less than under preclosure conditions. The comprehensive plans of the local communities may require revision. The zoning ordinances of the local communities may also require revision except for those administered by Sands Township, which are consistent with the proposed land uses. Under the Commercial Aviation Alternative, the high visual sensitivity areas along Silver Lead Creek and the golf course would remain unchanged from the closure baseline.

Under the Commercial Aviation Alternative, no new access points would be required and no significant effects on roadway transportation are expected.

No airspace conflicts or air transportation impacts are expected under the Commercial Aviation Alternative.

Utility consumption associated with the Commercial Aviation Alternative would be less than under the Proposed Action and could be accommodated by existing and future systems capacities. Impacts from the WWTP would be similar to those under the Proposed Action.

Hazardous Materials and Hazardous Waste Management. The quantities of hazardous materials and waste used and generated under the Commercial Aviation Alternative would be greater than under closure conditions but less than under the Proposed Action. SWMU, AOC, and IRP site remediation could cause some delays in redevelopment or require some land use restrictions. Other aspects of hazardous materials and waste management associated with this alternative would be similar to those discussed under the Proposed Action.

Natural Environment. The Commercial Aviation Alternative would result in minor effects on geology, soils, and water resources from ground disturbance associated with facility construction, renovation, and demolition, and infrastructure improvements. There is sufficient water supply from groundwater sources in the ROI. However, the use of two on-base wells at K. I. Sawyer AFB may be lowering the water levels at nearby lakes. If the wells are determined to be the cause of the lowering lake levels, alternate water supplies or reducing the yield from the existing wells may need to be investigated. Air pollutant emissions generated by this alternative would be less than under the Proposed Action and would be below federal and state standards.

Aircraft noise from Commercial Aviation Alternative aviation activities would result in increased noise levels when compared to closure conditions. However, by 2015 there would be 26,964 fewer acres exposed to DNL 65 dB or greater than under preclosure conditions. The number of people living in areas exposed to surface traffic noise levels of DNL 65 dB or greater would be 21 percent (112 persons) more than under the No-Action Alternative. Proper land use planning could reduce the effects of surface traffic noise.

Effects on biological resources would be minimal under the Commercial Aviation Alternative. Development could result in impacts to 0 to 9.5 acres of wetlands in the west and central parts of the base. Minimal impacts are expected, however, as ample opportunities exist for avoidance. Impacts to wetlands could be mitigated through avoidance or replacement. No federally or state-listed threatened and endangered species are expected to be impacted by the Commercial Aviation Alternative. Disposal activities could affect historic properties that are potentially eligible for listing in the NRHP. However, preservation covenants could be placed in the transfer documents

for Air Force fee-owned land to reduce impacts associated with conveyance to a nonfederal entity.

Environmental Justice. Environmental Justice impacts would be similar to those described under the Proposed Action except that surface traffic noise impacts would affect less people in low-income and minority population areas.

RECREATION ALTERNATIVE

Local Community. Redevelopment of the base property under this alternative would result in an increase in employment and population in the ROI. Reuse activities would increase employment levels by approximately 806 direct jobs and 370 secondary jobs by 2015, resulting in a total ROI employment of 65,241 in 2015. The Recreation Alternative would increase ROI population by approximately 863 persons, or 0.8 percent over the No-Action Alternative by 2015.

Noticeable changes in on-base land uses would occur due to civilian redevelopment. Proposed on-base land uses would generally be compatible with each other and with off-base land uses. The land uses proposed under the Recreation Alternative would generally be compatible with the comprehensive plans of the local townships. However, Marquette County and Forsyth Township would need to modify their comprehensive plans to include the small amount of industrial development proposed for this alternative. Forsyth Township would need to rezone to take into account the proposed land uses under its jurisdiction. West Branch and Sands townships would not need to rezone for the proposed land uses. Under the Recreation Alternative the high visual sensitivity areas along Silver Lead Creek and the golf course would remain unchanged from the closure baseline.

Under the Recreation Alternative no new access points would be required and no significant effects on roadway transportation are expected. No airspace conflicts or air transportation impacts are expected under the Recreation Alternative.

Utility consumption associated with the Recreation Alternative would be less than under the Proposed Action and could be accommodated by existing and future systems capacities. Impacts from the WWTP would be similar to the Proposed Action.

Hazardous Materials and Hazardous Waste Management. The quantities of hazardous materials and waste used and generated would be greater than under closure conditions but less than under the Proposed Action and other reuse alternatives. SWMU, AOC, and IRP site remediation could cause some delays in redevelopment or require some land use restrictions. Other

aspects of hazardous materials and waste management associated with this alternative would be similar to those discussed under the Proposed Action except there would be no reuse of the small arms firing range and no generation of medical/biohazardous waste.

Natural Environment. The Recreation Alternative would result in the fewest effects on geology, soils, and water resources from ground disturbance associated with facility construction, renovation, and demolition, and infrastructure improvements compared to the Proposed Action and other reuse alternatives. There is sufficient water supply from sources in the ROI. However, the use of two on-base wells at K. I. Sawyer AFB may be lowering the water levels at nearby lakes. If the wells are determined to be the cause of the lowering lake levels, alternate water supplies or reducing the yield from the existing wells may need to be investigated. Air pollutant emissions generated by this alternative would be less than under the Proposed Action, and would be below federal and state standards.

Under this alternative there would be no noise associated with aircraft operations. The number of people living in areas exposed to surface traffic noise levels of DNL 65 dB or greater would be 7 percent (39 persons) more than under the No-Action Alternative. Proper land use planning could reduce the effects of surface traffic noise.

Effects on biological resources would be minimal under the Recreation Alternative. Development could result in impacts to 0 to 2.5 acres of wetlands in the central portion of the base because of industrial development. Minimal impacts are expected, however, as ample opportunities exist for avoidance. Impacts to wetlands could be mitigated through avoidance or replacement. No federally or state-listed threatened and endangered species are expected to be impacted by the Recreation Alternative. Overall, this alternative would have the fewest effects on biological resources compared to the Proposed Action and other reuse alternatives. Disposal activities could affect historic properties that are potentially eligible for listing in the NRHP. However, preservation covenants could be placed in the transfer documents for Air Force fee-owned land to reduce impacts associated with conveyance to a nonfederal entity.

Environmental Justice. There are no impacts to Environmental Justice under the Recreation Alternative.

NO-ACTION ALTERNATIVE

Local Community. The only Air Force activities associated with the No-Action Alternative would be caretaker maintenance of the Air Force fee-owned property by the Air Force Base Disposal Agency Operating Location (OL). The other property owners would be responsible for maintenance of their own properties. Caretaker activities would generate approximately 50

direct and 13 secondary jobs throughout the 20-year analysis period. There would be no land use impacts from the No-Action Alternative. No effects on utilities or on road, air, or railroad transportation are expected.

Hazardous Materials and Hazardous Waste Management. Small quantities and various types of hazardous materials and pesticides would be used for this alternative. All materials and waste would be managed and controlled by the OL and caretaker team in accordance with applicable regulations. SWMU, AOC, and IRP site remediation would continue to occur at K. I. Sawyer AFB, with the OL providing utilities support and security for these actions. Storage tanks would be removed or maintained in place according to required standards. ACM would be managed in accordance with Air Force policy to protect human health and the environment. Pesticide usage would continue to be managed in accordance with FIFRA and state guidelines. Facilities that were constructed during or prior to 1978 may contain lead-based paint and would be secured.

Natural Environment. The No-Action Alternative would not cause adverse effects on geology, soils, water resources, air quality, noise, or biological resources. This alternative could have an overall beneficial effect on biological resources as a result of the reduction in human activity, noise, and ground disturbance compared to preclosure conditions. Adequate caretaker maintenance would preclude the deterioration of any important historic properties.

Environmental Justice. The No-Action Alternative would not cause any effects to Environmental Justice.

OTHER LAND USE CONCEPTS

Other independent land uses are analyzed in terms of their effects on employment, population, and the environment when combined with the Proposed Action and alternatives. The five independent land use concepts analyzed in this EIS are the MANG, a correctional institution, a sawmill, a waste to energy/recycling facility, and a waste to energy/environmental support operations facility. Impacts on the local community and the environment, if these proposals are implemented, are summarized in Table S-3.

Michigan Army National Guard. The MANG expressed interest in utilizing portions of the base property as a headquarters for the 107th Combat Engineering Battalion. This proposal would involve an average of 30 weekend drills per year, each consisting of approximately 150 people. Activities would include vehicle maintenance, use of the rifle range, and driver skills training. The only potential additional effects associated with this concept in conjunction with the alternatives would be the small amounts of hazardous materials used and waste generated and effects on wetlands.

Table S-3. Summary of Impacts from Other Land Use Concepts
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Resource Category	Michigan Army National Guard	Correctional Institution	Sawmill	Waste to Energy/ Recycling	Waste to Energy/ Environmental Support Operations
Local Community					
Land Use and Aesthetics	Compatible with adjacent land uses. No visual impacts	Compatible with adjacent land uses. No visual impacts	**Operation.** Compatible with adjacent land uses. No visual impacts **Harvest.** No change in land use. Potential for visual and recreational impacts from increased timber harvesting. Clear cutting would produce the most effects	Compatible with adjacent land uses. No visual impacts	Compatible with adjacent land uses. No visual impacts
Transportation	150 weekend trips. Potential changes in traffic volume would not affect Level of Service	650 daily trips. Changes in traffic volume may affect Level of Service	**Operation.** 60 vehicles per hour during peak hour. Changes in traffic volume would have little effect on Level of Service **Harvest.** 20 truck loads of timber transported per day. Increase in volume would have little effect on Level of Service	50 vehicles per hour during peak hour. Changes in traffic volume would have little effect on Level of Service	70 vehicles per hour during peak hour. Changes in traffic volume would have little effect on Level of Service

Note: Implementation of these other land use concepts in conjunction with the Proposed Action or alternatives may require the use of the same suggested mitigation measures for each resource area in Table S-2.

Table S-3. Summary of Impacts from Other Land Use Concepts
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Resource Category	Michigan Army National Guard	Correctional Institution	Sawmill	Waste to Energy/ Recycling	Waste to Energy/ Environmental Support Operations
Local Community (Continued)					
Utilities	Potential changes in utility use would not exceed system capacities	Potential changes in utility use would not exceed system capacities	**Operation.** Potential changes in utility use would not exceed system capacities **Harvest.** No impact.	Potential changes in utility use would not exceed system capacities. Net reduction in solid waste generation and electrical use	Potential changes in utility use would not exceed system capacities. Net reduction in solid waste generation and electrical use
Hazardous Materials and Hazardous Waste Management					
Hazardous Materials Management	Small amounts used during maintenance activities. Management in compliance with applicable regulations	Small amounts used during maintenance activities. Management in compliance with applicable regulations	**Operation.** Small amounts used during maintenance activities. Management in compliance with applicable regulations **Harvest.** Increase use of fuel, antifreeze, and lubricants for harvesting equipment.	Small amounts used during maintenance activities. Management in compliance with applicable regulations	Small amounts used during maintenance activities. Management in compliance with applicable regulations

Note: Implementation of these other land use concepts in conjunction with the Proposed Action or alternatives may require the use of the same suggested mitigation measures for each resource area in Table S-2.

Table S-3. Summary of Impacts from Other Land Use Concepts
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Resource Category	Michigan Army National Guard	Correctional Institution	Sawmill	Waste to Energy/ Recycling	Waste to Energy/ Environmental Support Operations
Hazardous Materials and Hazardous Waste Management (Continued)					
Hazardous Waste Management	Small quantities generated by maintenance activities. Management of waste in compliance with applicable regulations	Small quantities generated by maintenance activities. Management of waste in compliance with applicable regulations	**Operation.** Small quantities generated by maintenance activities. Management of waste in compliance with applicable regulations **Harvest.** Increased potential for fuel, antifreeze, and lubricant leaks from harvesting equipment	Small quantities generated by maintenance activities. Transportation and storage of waste from recycling operations. Management of waste in compliance with applicable regulations	Small quantities generated by maintenance activities. Transportation and storage of waste from off-site cleanup operations. Management of waste in compliance with applicable regulations
Installation Restoration Program	No impact	No impact	**Operation.** No impact **Harvest.** No impact	No impact	No impact
Storage Tanks	No impact	No impact	**Operation.** No impact **Harvest.** No impact	No impact	No impact

Note: Implementation of these other land use concepts in conjunction with the Proposed Action or alternatives may require the use of the same suggested mitigation measures for each resource area in Table S-2.

Table S-3. Summary of Impacts from Other Land Use Concepts
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Resource Category	Michigan Army National Guard	Correctional Institution	Sawmill	Waste to Energy/ Recycling	Waste to Energy/ Environmental Support Operations
Hazardous Materials and Hazardous Waste Management (Continued)					
Asbestos	May require management of asbestos-containing material in accordance with the National Emissions Standards for Hazardous Air Pollutants	No impact	**Operation.** May require management of asbestos-containing material in accordance with the National Emissions Standards for Hazardous Air Pollutants **Harvest.** No impact	May require management of asbestos-containing material in accordance with the National Emissions Standards for Hazardous Air Pollutants	May require management of asbestos-containing material in accordance with the National Emissions Standards for Hazardous Air Pollutants
Pesticide Usage	Small quantities used. Management in accordance with applicable regulations	Small quantities used. Management in accordance with applicable regulations	**Operation.** Small quantities used. Management in accordance with applicable regulations **Harvest.** Increased use of pesticides for site preparation. Use in accordance with applicable regulations	Small quantities used. Management in accordance with applicable regulations	Small quantities used. Management in accordance with applicable regulations
Polychlorinated Biphenyls	No impact	No impact	**Operation.** No impact **Harvest.** No impact	No impact	No impact

Note: Implementation of these other land use concepts in conjunction with the Proposed Action or alternatives may require the use of the same suggested mitigation measures for each resource area in Table S-2.

Table S-3. Summary of Impacts from Other Land Use Concepts
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Resource Category	Michigan Army National Guard	Correctional Institution	Sawmill	Waste to Energy/ Recycling	Waste to Energy/ Environmental Support Operations
Hazardous Materials and Hazardous Waste Management (Continued)					
Radon	No impact	No impact	**Operation.** No impact **Harvest.** No impact	No impact	No impact
Medical/Biohazardous Waste	None generated	Managed in accordance with applicable regulations	**Operation.** None generated **Harvest.** No impact	None generated	None generated
Ordnance	Small amounts used with arms proficiency training. Spent shells managed in accordance with applicable regulations	No impact	**Operation.** No impact **Harvest.** No impact	No impact	No impact
Lead-Based Paint	May require management of lead-based paint in accordance with applicable regulations	No impact	**Operation.** May require management of lead-based paint in accordance with applicable regulations **Harvest.** No impact	May require management of lead-based paint in accordance with applicable regulations	May require management of lead-based paint in accordance with applicable regulations

Note: Implementation of these other land use concepts in conjunction with the Proposed Action or alternatives may require the use of the same suggested mitigation measures for each resource area in Table S-2.

Table S-3. Summary of Impacts from Other Land Use Concepts
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Resource Category	Michigan Army National Guard	Correctional Institution	Sawmill	Waste to Energy/ Recycling	Waste to Energy/ Environmental Support Operations
Natural Environment					
Geology and Soils	Minor ground disturbance associated with driver training of equipment	Up to 161 acres of ground disturbance Potential increase in soil erosion	**Operation.** Ground disturbance of up to 2 acres during construction **Harvest.** Increased soil disturbance and sedimentation from harvest management	No impact	No impact
Water Resources	Minor increase in sediment loading. No adverse impact due to change in water demand	Potential increase in sediment loading during construction. No adverse impact due to change in water demand	**Operation.** Potential increase in sediment loading during construction. No adverse impact due to change in water demand **Harvest.** Localized water quality impacts from increased sedimentation and removal of vegetation	No adverse impact due to change in water demand	Potential for minor increase in sediment loading during construction. No adverse impact due to change in water demand
Air Quality	No impact	No impact	**Operation.** No impact **Harvest.** No impact	No impact	No impact

Note: Implementation of these other land use concepts in conjunction with the Proposed Action or alternatives may require the use of the same suggested mitigation measures for each resource area in Table S-2.

Table S-3. Summary of Impacts from Other Land Use Concepts

Resource Category	Michigan Army National Guard	Correctional Institution	Sawmill	Waste to Energy/ Recycling	Waste to Energy/ Environmental Support Operations
Natural Environment (Continued)					
Noise	No impact	No impact	**Operation.** No impact **Harvest.** Increased noise levels to recreational areas from timber harvesting activities	No impact	No impact
Biological Resources	Potential impact to 5 acres of wetlands. No impact to threatened or endangered species	Potential impact to wetlands along eastern boundary of the site. No impact to threatened or endangered species	**Operation.** Potential impact to small drainage ditch wetland areas. No impact to threatened or endangered species **Harvest.** Increased loss of wildlife habitat could affect some species populations	No impact	No impact
Cultural Resources	No impact	No impact	**Operation.** No impact **Harvest.** Potential for increased damage to unidentified cultural resource sites on state and private lands	No impact	No impact

Note: Implementation of these other land use concepts in conjunction with the Proposed Action or alternatives may require the use of the same suggested mitigation measures for each resource area in Table S-2.

All hazardous materials and wastes would be handled in accordance with applicable federal, state, and local regulations by qualified personnel. There are 5 acres of wetlands within the area proposed for this concept. However, this area could be avoided during the driver skills training.

Correctional Institution. This concept involves approximately 273 acres in the northwest portion of the base and would include construction of 500,000 square feet of one- and two-story buildings within a fenced compound. Construction would begin 5 years after closure. This concept would involve 250 full-time employees and up to 1,600 inmates. The only potential additional effects associated with this concept in conjunction with the Proposed Action and alternatives would be to local traffic, hazardous materials used and waste generated, geology and soils, water resources, and wetlands. The increased traffic generated from this concept may affect the LOS near the base; however, implementation of road improvements could reduce traffic congestion. The hazardous materials used and wastes generated would be handled in accordance with applicable federal, state, and local regulations by qualified personnel. Construction of the correctional institution would increase soil erosion, which may increase sediment loading. Implementation of appropriate mitigation measures would reduce the short-term effect from construction-related soil erosion. The wetlands along the eastern boundary of the proposed correctional institution site could be avoided.

Sawmill. The sawmill concept would include approximately 142 acres, or 3 percent of the base area, for use as a sawmill including a dry kiln and planing mill. The facility would require construction of a sawmill, boiler, planing mill, and dry kiln. Total facility construction would be approximately 25,000 square feet, requiring 2 acres to be disturbed. The sawmill would employ approximately 90 personnel at the base and would process between 45 and 75 million board-feet of timber annually. Timber for the mill would be obtained from the northern Lower Peninsula of Michigan, the Upper Peninsula, and northeast Wisconsin, and would consist of spruce, balsam, pine, hemlock, and tamarack. The only potential additional effects at K. I. Sawyer AFB associated with this concept in conjunction with the Proposed Action and alternatives would be from the small amounts of hazardous materials used and waste generated, and effects to water resources and wetlands. All hazardous materials and wastes would be handled in accordance with applicable federal, state, and local regulations by qualified personnel. Construction of the sawmill would increase soil erosion which may increase sediment loading. Implementation of appropriate mitigation measures would reduce the short-term effect from construction-related soil erosion. There are wetlands within the area proposed for this concept. However, this area could be avoided during construction activities.

Waste to Energy/Recycling. This concept would include the use of Buildings 417, 419, and 735, and the base heating plant for use as a

recycling center and waste to energy facility utilizing municipal solid waste as a fuel source. Initially this concept would receive approximately 35 tons per day of municipal solid waste from the Marquette area. Recyclable material such as glass, plastics, aluminum, ferrous metals, precious metals, and rags would be removed from the municipal solid waste and would be recycled at this facility. This concept should reduce the amount of municipal solid waste going to landfills by 85 percent. This concept would employ approximately 50 personnel at the base. The only potential additional effects associated with this concept in conjunction with the Proposed Action and alternatives would be from the small amounts of hazardous materials used and waste generated and effects to air quality. All hazardous materials and wastes would be handled in accordance with applicable federal, state, and local regulations by qualified personnel. Compliance with applicable federal and state permit requirements and conditions would preclude adverse impacts from criteria and hazardous air pollutant emissions during operations.

Waste to Energy/Environmental Support Operations. This proposed land use concept would involve reuse of Building 540, heating plant, Building 824, Building 643, and Building 826. Under this concept, a waste to energy incineration system would be placed into operation at the base heating plant. The system would be fueled by solid municipal waste, used tires, and other materials, including sawdust, wood chips, construction waste, and some industrial waste. Up to 1,200 tons per day of waste material could be processed by the plant. Some new construction within the heating plant area would be required for chipping and waste storage areas. Other operations associated with this land use concept would be handling and temporary storage of hazardous materials and wastes collected from cleanup or spill response activities, tank removal/installation, and construction services. Additionally, approximately 5,000 to 10,000 gallons per day of sanitary waste from septic systems would be brought to the base WWTP for processing. This concept would employ approximately 100 personnel. The only potential additional effects associated with this concept in conjunction with the Proposed Action and alternatives would be from the hazardous materials used and waste generated and effects to air quality. All hazardous materials and wastes would be handled in accordance with applicable federal, state, and local regulations by qualified personnel. Compliance with applicable federal and state permit requirements and conditions would preclude adverse impacts from criteria and hazardous air pollutant emissions during operations.

MARQUETTE COUNTY AIRPORT REUSE

The Proposed Action, International Wayport Alternative, and Commercial Aviation Alternative assume relocation of aircraft operations from Marquette County Airport to K. I. Sawyer AFB. With K. I. Sawyer AFB serving as a regional airport, the Marquette area would not need a second airport at the

existing Marquette County Airport site. No definite plans for the closure and reuse of Marquette County Airport have been developed by the K. I. Sawyer Base Conversion Authority or any other local agency. Based on conversations with local officials and airport representatives, it was assumed that the airport could be developed for a combination of industrial, institutional (educational and government), commercial, residential, and public facilities/recreation uses. Potential impacts from development of the airport are listed below.

Local Community. Reuse activities associated with the industrial, institutional (education and government), commercial, residential, and public facilities/recreation development at Marquette County Airport would generate new jobs in the Negaunee and Marquette areas and could potentially increase local population.

Closure and reuse of the Marquette County Airport would require an update to the Negaunee Township Comprehensive Plan to reflect proposed uses. Depending upon the final development selected, the township would need to ensure that the proposed land uses are consistent with zoning for the airport property. The types of uses assumed to occur with reuse of the airport are generally compatible with the surrounding land uses.

No significant effects on roadway transportation are expected. The reuse of Marquette County Airport as a non-aviation-related facility would not impact regional air transportation or airspace. All of the local utility purveyors have sufficient design capacities to meet the needs of reuse development at this site.

Hazardous Materials and Hazardous Waste Management. The hazardous materials expected to be used at the site would be associated with industrial, institutional, commercial, residential, and public facilities/ recreation uses. All hazardous materials used and waste generated would be handled in accordance with applicable regulations. Contaminated site remediation at the airport could cause some delays in redevelopment or require some land use restrictions. Because of the construction date of some of the facilities at the airport, there is the potential for them to contain ACM and lead-based paint. Any demolition or renovation of facilities at the airport should be monitored to minimize the potential risk to human health and the environment.

Natural Environment. Effects of reuse of the site on the regional geology and soils and water resources would be minimal, and would primarily result from ground disturbance associated with facility construction, renovation, demolition, and infrastructure improvement. Air pollutant emissions generated by reuse of the airport should not affect the region's attainment status.

With the relocation of aircraft operations from Marquette County Airport, noise generated by airport-related activities would be eliminated. There may be some increase in noise levels along U.S. 41 from increased traffic related to reuse of the site. Because the anticipated disturbance at Marquette County Airport would be mostly in previously disturbed areas, development, demolition, or new construction impacts would be minimal. Designation of some areas as recreation/open space would encourage regrowth of native vegetation and would benefit the vegetation communities. No impacts to threatened or endangered species are expected from the reuse of Marquette County Airport, since no listed species are known to be present at this time. Development could result in impacts to wetlands on the property. However, development in wetlands would be subject to state and/or federal permits which should preclude impacts. The site contains no known cultural resources.

SAWMILL TIMBER HARVESTING ACTIVITIES

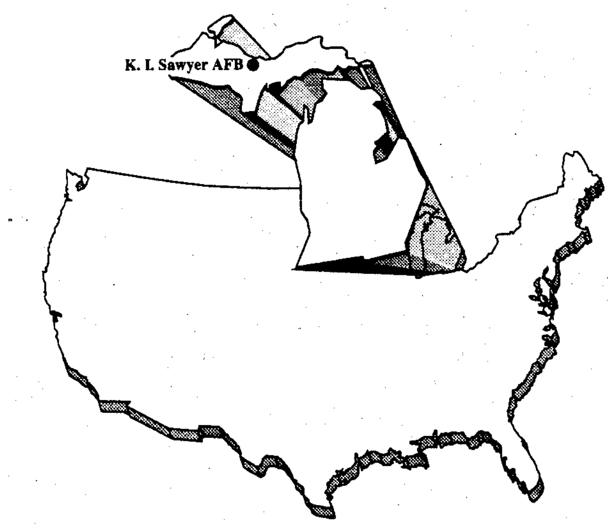
This section summaries the environmental consequences of timber harvesting activities for the proposed sawmill at K. I. Sawyer AFB. Harvesting activities could occur in the Lower Peninsula of Michigan, the Upper Peninsula of Michigan, and in northeast Wisconsin. The timber to be harvested would consist of softwoods.

The results of the analysis conducted for the proposed sawmill at K. I. Sawyer AFB concluded that the timber harvest could be increased within the procurement area to meet the needs of the proposed sawmill. The net annual growth rate of the softwood species to be utilized by the proposed sawmill is 97 million cubic feet, and the current estimated harvest within the procurement area is approximately 79 million cubic feet. Therefore, the proposed sawmill estimated maximum requirement of 75 million board feet (6.4 million cubic feet) would utilize approximately 35 percent of the annual growth.

Effects from timber harvesting activities and the extent to which they may occur depends on the timing of the harvest, amount of timber harvested, the harvesting method, where the harvest takes place, and the changes that result from the timber harvest. Most of the effects can be avoided or minimized through compliance with existing regulations; applications of appropriate forest best management practices; and adherence to forest management plans, where applicable.

Timber harvesting activities overall would not change land use since the area is managed for timber. Timber harvesting would increase impacts to recreational and visual resources within the procurement area. Clearcutting, which represents 62 percent of the expected harvest method, would have the greatest effects on recreational and visual resources. Increased truck traffic from timber hauling would not affect the level of service on regional

roads. Approximately 44 miles of dirt roads per year would be created into the timber harvest area. With increased equipment use for timber harvesting activities there would be the potential for fuel, antifreeze, and lubricant leaks from the equipment. In addition, the use of pesticides would also increase as more areas are prepared for revegetation. Timber harvesting activities would increase soil disturbance especially during the construction of logging roads. The soil disturbance could lead to increased sedimentation in water resources which could create localized impacts. No air quality impacts are anticipated from the timber harvesting activities. Increased noise levels could affect nearby recreational resources if harvesting occurs during peak recreational periods. The increased timber harvesting could impact biological resources within the procurement area. Most impacts would be associated with the loss of habitat for wildlife species including threatened and endangered species. Most impacts to threatened and endangered species would be avoided through consultation requirements under the Endangered Species Act. Much of the timber procurement area has not been surveyed for cultural resources. Increased ground disturbance from harvesting activities could impact unidentified prehistoric and historic sites on state and private lands.



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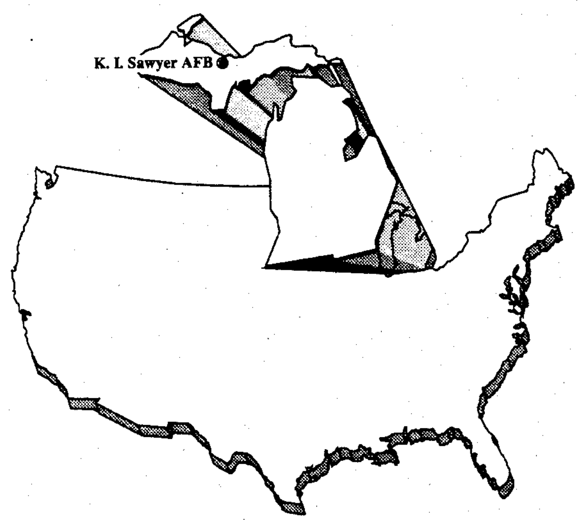


CHAPTER 1
PURPOSE OF AND NEED FOR ACTION

1.0 PURPOSE OF AND NEED FOR ACTION

This Environmental Impact Statement (EIS) examines the potential for impacts to the environment as a result of the disposal and reuse of K. I. Sawyer Air Force Base (AFB), Michigan, as well as with interim activities (e.g., interim outleases) that may be allowed by the Air Force before final disposal of the base. This document has been prepared in accordance with the National Environmental Policy Act (NEPA) of 1969 and the Council on Environmental Quality (CEQ) regulations implementing NEPA. Appendix A presents a glossary of terms, acronyms, and abbreviations used in this document.

1.1 PURPOSE OF AND NEED FOR

Due to the changing international political scene and the resultant shift toward a reduction in defense spending, the Department of Defense (DOD) must realign and reduce its military forces pursuant to the Defense Base Closure and Realignment Act (DBCRA) of 1990 (Public Law [P.L.] 101-510, Title XXIX). DBCRA established new procedures for closing or realigning military installations in the United States.

DBCRA established an independent Defense Base Closure and Realignment Commission (hereafter "Commission") to review the Secretary of Defense's base closure and realignment recommendations. After reviewing these recommendations, the 1993 Commission forwarded its recommended list of base closures and realignments to the President, who accepted the recommendations and submitted them to Congress on July 2, 1993. Since Congress did not disapprove the recommendations within the time period provided under DBCRA, the recommendations have become law.

Because K. I. Sawyer AFB was on the Commission's list, the decision to close the base is final. K. I. Sawyer AFB was closed in September 1995.

To fulfill the requirement of reducing defense expenditures, the Air Force plans to dispose of excess and surplus real property and facilities at K. I. Sawyer AFB. DBCRA requirements relating to disposal of excess and surplus property include:

- Environmental restoration of the property as soon as possible with funds made available for such restoration
- Consideration of the local community's conceptual planning prior to Air Force decision making regarding disposal of the property
- Compliance with specific federal property disposal laws and regulations.

The Air Force action, therefore, is to dispose of K. I. Sawyer AFB property and facilities. Usually this action is taken by the Administrator of General Services. However, DBCRA required the Administrator to delegate to the Secretary of Defense the authorities to utilize excess property, dispose of surplus property, convey airport and airport-related property, and determine the availability of excess or surplus real property for wildlife conservation purposes. The Secretary of Defense has since redelegated these authorities to the respective Service Secretaries.

1.2 DECISIONS TO BE MADE

The purpose of this EIS is to provide information for interrelated decisions concerning the disposition of K. I. Sawyer AFB. The EIS is to provide the decision maker and the public the information required to understand the future potential environmental consequences of disposal as a result of reuse options at K. I. Sawyer AFB.

After completion of this EIS, the Air Force will issue a Record of Decision (ROD) on the disposal of K. I. Sawyer AFB. The ROD will document the Air Force's decisions on the following:

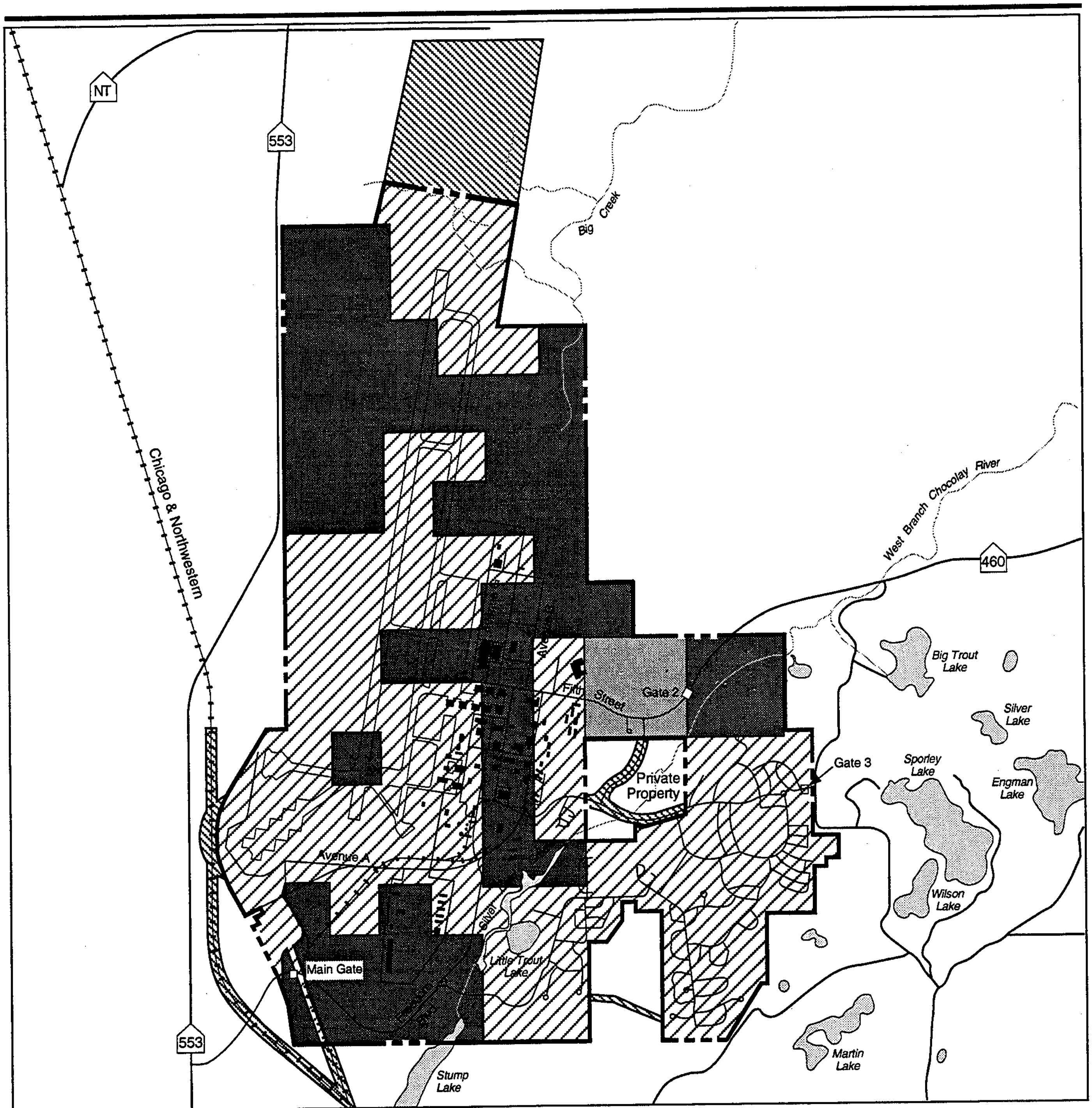
- The methods of disposal available to the Air Force
- The terms and conditions of reuse.

The methods of disposal granted by the Federal Property and Administrative Services Act of 1949 and the Surplus Property Act of 1944 and implemented in the Federal Property Management Regulations (FPMR) are:

- Transfer to another federal agency
- Public benefit conveyance to an eligible entity
- Negotiated sale to a public body for a public purpose
- Competitive sale by sealed bid or auction.

In addition, amendments in the National Defense Authorization Act for 1994 (P.L. 103-160), Chapter XXIX, authorize conveyances of surplus property to local redevelopment authorities at discounted prices when a public benefit will result.

The EIS considers environmental impacts of the Air Force's disposal of that portion of the base property unconditionally owned by the Air Force. The real estate portion unconditionally owned by the Air Force comprises approximately 56 percent (2,762 acres) of the base land (Figure 1.2-1). The remaining 44 percent (2,161 acres) of base land (non-fee-owned property) currently controlled by the Air Force has been acquired for limited durations from numerous individuals and agencies, including the state of Michigan, county of Marquette, and the U.S. Department of the Interior (DOI). This area includes approximately 2,001 acres of state and approximately 160



EXPLANATION

- Owned (Fee)
- Leased
- Public Domain
- Right-of-Way/Aviation Easement
- Base Boundary

0 950 1900 3800 Feet

Air Force Real Estate Interests on K. I. Sawyer AFB

Figure 1.2-1

acres of DOI property. The Air Force must surrender its limited rights to this property when the land is no longer needed for military purposes and after legal obligations relating to the Air Force's use of the property have been satisfied. Because the Air Force decision on whether and how to dispose of the Air Force fee-owned property may influence how the other 44 percent of the base property will be reused, the EIS analyzes the environmental effects of the overall reuse of all of the base property. The Proposed Action and alternatives evaluated in this EIS consider all of the area within the base boundary. Under the lease agreement with the state of Michigan, the Air Force could be required to return the state leased land at K. I. Sawyer AFB to its natural condition upon termination of the lease, if requested by the designated state authority and if facilities and infrastructure are not utilized or needed in the future by the state. This land includes open forested areas as well as areas developed by the Air Force within the central portion of the base. Under the Proposed Action and alternatives analyzed in this EIS, various ranges of facility demolition and land restoration were assumed, to cover requests by the state of Michigan to return portions of the base to its natural condition. Under the Recreation Alternative, approximately 80 percent of the base would be restored to its natural condition, which is an area greater than that owned by the state.

The EIS portrays, as alternatives, a variety of potential land uses to cover reasonable future uses of the property and facilities by others. Five alternative scenarios were used to group reasonable land uses and to examine the environmental effects of redevelopment of K. I. Sawyer AFB. This methodology was employed because, although the disposal will have few, if any, direct effects, future use and control of use by others will create indirect effects. This EIS, therefore, seeks to analyze reasonable redevelopment scenarios to determine the potential indirect environmental effects of Air Force decisions.

1.3 DISPOSAL PROCESS AND REUSE PLANNING

DBCRA requires compliance with NEPA (with some exceptions) in the implementation of the base closures and realignments. Among the issues that were excluded from NEPA compliance are:

- The selection of installations for closure or realignment
- Analysis of closure impacts.

The Air Force goal is to dispose of its 2,762 acres of K. I. Sawyer AFB property through transfer and/or conveyance to other government agencies or private parties. The Proposed Action in the EIS reflects the community's goal for base reuse, which is to redevelop the disposal property as an aviation, industrial, and commercial complex.

For the purpose of conducting the environmental analysis, the Air Force has based the Proposed Action on plans developed by the K. I. Sawyer Base Conversion Authority. The Air Force has also considered additional reasonable alternatives in order to provide the decision maker with multiple options regarding ultimate property disposition. In all cases, the impacts of long- or short-term leasing have been identified to cover the range of potential reuse options for the base. Subject to the terms of transfer or conveyance, the recipients of the property, planning and zoning agencies, and elected officials will ultimately determine the reuse of the property. Four alternatives to the Proposed Action have been identified, which include two aviation and one non-aviation reuse and a No-Action Alternative, which would not involve reuse. The Air Force has also evaluated five independent land use concepts that could be implemented individually or in combination with any alternative.

The Secretary of the Air Force (or his/her designee) has full discretion in determining how the Air Force will dispose of its 2,762 acres of Air Force fee-owned property. DBCRA requires the Air Force to comply with federal property disposal laws and FPMR (41 Code of Federal Regulations [CFR] 101-47). Another provision of the act requires the services to consult with the Governor and heads of local governments, or equivalent political organizations for the purpose of considering any plan for the use of such property by the local community concerned. Accordingly, the Air Force is working with state authorities and the K. I. Sawyer Base Conversion Authority to meet this requirement.

Generally, the Administrator of the General Services Administration (GSA) has authority to dispose of excess and surplus real property belonging to the federal government. With regard to closure bases, however, the DBCRA requires the GSA Administrator to delegate disposal authority to the Secretary of Defense. FPMR, which govern property disposal methods associated with base closure, allow the Secretary of Defense to dispose of closure property by transfer to another federal agency, by public benefit conveyance, by negotiated sale to state or local government, and by public sale at auction or by sealed bid. These methods, or a combination of them, could be used to dispose of Air Force fee-owned property at K. I. Sawyer AFB.

Property transfers are usually made by deed when the property is legally suitable for conveyance. However, for some parcels, near-term deed conveyance is not lawful initially under the requirements of Section 120 (h)(3) of the Comprehensive Environmental Restoration, Compensation and Liability Act (CERCLA), because they may contain hazardous wastes for which necessary levels of remedial action have not yet been taken. The Air Force attempts to support the community's rapid redevelopment of the base by transferring parts of such property by long-term leases in furtherance of eventual deed conveyance. Such leases are accompanied by a contractual

commitment between the parties for the Air Force to convey deed title to the property as soon as it can legally do so. Land reuses, whether by short-term or long-term leases or by deed, and their resulting environmental impacts, generally are not affected by the form of conveyance. However, the differences in the legal relationships of the parties are of significant concern to the Air Force. Where the Air Force is the landlord, it is potentially exposed to legal liability to third parties or to applicable regulatory enforcement actions resulting from improper environmental conditions or actions occurring on the leased property by its tenants, and thus the Air Force has incentive to assure that its lessees comply with all legal regulatory requirements as well as the environmentally protective restrictive provision of the lease. The contractual nature of lease restrictions makes them easier and faster to enforce than deed covenants.

Provisions of DBCRA and FPMR require that the Air Force first notify other DOD departments that K. I. Sawyer AFB is scheduled for disposal. Any proposals from these departments for the transfer of Air Force fee-owned property at K. I. Sawyer AFB are given priority consideration.

Pursuant to the McKinney Act (42 U.S. Code [U.S.C.] § 11411), the Air Force was required to provide the U.S. Department of Housing and Urban Development (HUD) with information regarding properties being disposed of at closing installations. HUD would then make a determination about the suitability of these properties for homeless assistance programs and report the suitability and potential availability of those installation facilities in the Federal Register. Although the Base Closure Community Redevelopment and Homeless Assistance Act of 1994 amended DBCRA of 1990 by eliminating the McKinney Act's application to base closures, the K. I. Sawyer Base Conversion Authority has chosen to proceed with the process outlined under the McKinney Act.

Under the provisions of the McKinney Act, properties advertised by HUD in the Federal Register will be held only for the purpose of assisting the homeless for a period of 60 days from the date of the Federal Register publication. During this time, homeless providers will be able to express written interest to the U.S. Department of Health and Human Services (HHS) in the properties being advertised. This 60-day period is also effective for each subsequent publication of the property in the Federal Register.

HHS must receive completed applications for McKinney Act properties within 90 days from the date the expression of interest was received. HHS then has to make a determination of approval within 25 days of receiving the completed application. If approved, the property will be assigned to HHS from the Air Force when it becomes surplus. HHS will then transfer the property, at no cost, to the approved homeless provider.

Prior to making property available for use to assist the homeless, the Air Force may consider other federal uses and other important national needs. In deciding the disposition of surplus property, a priority of consideration will be given to uses which assist the homeless, unless it is determined that a competing request for the property that serves one of the public benefits specified under 40 U.S.C. § 484(k) is so meritorious and compelling as to outweigh the needs of the homeless.

During the screening period, the Air Force Base Conversion Agency (AFBCA) consulted with representatives of the homeless and conducted outreach. In summer 1994, a homeless assistance provider meeting was held for the communities surrounding K. I. Sawyer AFB. No interest in base housing was expressed during this meeting and no other requests have been received.

Native American tribes have potential statutory rights relating to both "excess" and "surplus" federal real property. Excess real property may be transferred to DOI pursuant to 40 U.S.C. § 483(a)(1) under the following three conditions: (1) DOI requests the property; (2) Air Force approves the DOI request based on an evaluation of criteria contained in the FPMR at 41 CFR Part 101-47; and (3) DOI pays fair market value for the land or obtains a fair market value waiver from the Office of Management and Budget. Former reservation property that was utilized by a military department for military basing purposes may be transferred to the Secretary of the Interior pursuant to 40 U.S.C. § 483(a)(2), after the property becomes excess to the needs of the DOD.

Under the provisions of the Indian Self Determination Act, the Secretary of the Interior may contract with a tribe to execute certain functions of DOI in providing services to the members of the tribe. For the execution of these contracts, the tribe may use available federal facilities under the control of DOI. Moreover, DOI may request the transfer of excess or surplus federal real or personal property to DOI for these purposes (25 U.S.C. § 450j[f][3]).

Surplus federal real property may be transferred to Native American tribes under one of the public benefit conveyance authorities if the tribe is eligible for such public benefit or reduced cost transfer. Notwithstanding the aforementioned disposal methods, Native American tribes may also acquire surplus federal real property by public sale much like any other private entity.

Until property can be disposed of by deed, the Air Force may execute interim or long-term leases to allow reuse to begin as quickly as possible. The Air Force would structure the leases to provide the lessees with maximum control over the property, consistent with the terms of the final disposal. Restrictions on reuse and access may be necessary to ensure protection of human health and the environment and to allow

implementation of required remedial actions. In most cases, compliance with environmental laws does not interfere with reuse of some parts of the base. Environmental analysis in the EIS encompasses those possible interim or long-term leasing decisions.

Certain activities inherent in the development or expansion of an airport constitute federal actions that fall under the statutory and regulatory authority of the Federal Aviation Administration (FAA). The FAA generally reviews these activities through the processing and approval of an Airport Layout Plan (ALP). Goals of the ALP review system are to: (1) determine its effectiveness in achieving safe and efficient utilization of airspace, (2) assess factors affecting the movement of air traffic, and (3) establish conformance with FAA design criteria. The FAA approval action may also include other specific elements, such as preparation of the Airport Certification Manual (Part 139); the Airport Security Plan (Part 107); the location, construction, or modification of an air traffic control (ATC) tower, terminal radar approach control (TRACON) facility, other navigational and visual aids, and facilities; and establishment of instrument approach procedures.

In view of its possible direct involvement with the disposal of K. I. Sawyer AFB, the FAA is serving as a cooperating agency in the preparation of the EIS. If surplus property is conveyed to a local agency for airport purposes, the FAA will be the federal agency that would enforce deed covenants requiring the property to be used for airport purposes. Additionally, the FAA may later provide airport improvement program grants to the airport sponsor (local agency taking title). The FAA also has special expertise and the legal responsibility to make recommendations to the Air Force for the disposal of surplus property for airport purposes. The Surplus Property Act (recodified at 49 U.S.C § 47151) authorizes disposal of surplus real and related personal property for airport purposes and requires the FAA to certify that the property is necessary, suitable, and desirable for an airport.

The potential environmental impacts of airport development must be assessed prior to commitment of federal funding, in accordance with NEPA and FAA Orders 1050.1D, Policies and Procedures for Considering Environmental Impacts, and 5050.4A, Airport Environmental Handbook. Environmental impacts must be assessed prior to authorization of plans of local agencies for the development of the entire area in which the airport is located. Section 4(f) of the Department of Transportation (DOT) Act (recodified at 49 U.S.C., Subtitle I, Section 303) provides that the Secretary of Transportation shall not approve any program or project that requires the use of any publicly owned land from a public park, recreation area, or wildlife and waterfowl refuge of national, state, or local significance or land of an historic site of national, state, or local significance as determined by the officials having jurisdiction thereof unless there is no feasible and

prudent alternative to the use of such land, and such program or project includes all possible planning to minimize harm resulting from the use.

Compliance with FAA regulations requires the preparation of a proposed airport development plan. This EIS presents the assessment of potential environmental impacts of available plans. If a reuse proponent has developed only conceptual plans for the airport area, the environmental impacts of that plan are analyzed. The FAA may then use this document to complete their NEPA requirements. This EIS also provides environmental analysis to aid FAA decisions on funding requests for airport development projects. The new owners would be required to prepare a final ALP and submit it to the FAA, as appropriate, for approval.

1.4 ENVIRONMENTAL IMPACT ANALYSIS PROCESS

NEPA established a national policy to protect the environment and ensure that federal agencies consider the environmental effects of actions in their decision making. The CEQ is authorized to oversee and recommend national policies to improve the quality of the environment, and has published regulations that describe how NEPA should be implemented. The CEQ regulations encourage federal agencies to develop and implement procedures that address the NEPA process in order to avoid or minimize adverse effects on the environment. Air Force Instruction (AFI) 32-7061, Environmental Impact Analysis Process (EIAP), addresses implementation of NEPA as part of the Air Force planning and decision-making process.

NEPA, CEQ regulations, FAA Orders 1050.1D and 5050.4A, and AFI 32-7061 provide guidance on the types of actions for which an EIS must be prepared. Once it has been determined that an EIS must be prepared, the proponent must publish a Notice of Intent (NOI) to prepare an EIS. This formal announcement signifies the beginning of the scoping period, during which the major environmental issues to be addressed in the EIS are identified. A Draft EIS (DEIS) is prepared, which includes the following:

- A statement of the purpose of and need for the action
- A description of the Proposed Action and alternatives, including the No-Action Alternative
- A description of the environment that would be affected by the Proposed Action and alternatives
- A description of the potential environmental consequences of the Proposed Action and alternatives, and potential mitigation measures.

The DEIS is filed with the U.S. Environmental Protection Agency (EPA) and is circulated to the interested public and government agencies for a period of at least 45 days for review and comment. During this period, a public hearing will be held so that the proponent can summarize the findings of the analysis and receive input from the affected public. At the end of the review period, all substantive comments received must be addressed. A Final EIS (FEIS) is produced that contains responses to comments, as well as changes to the document, if necessary.

The FEIS is then filed with U.S. EPA and distributed in the same manner as the DEIS. Once the FEIS has been available for at least 30 days, the Air Force may publish its ROD for the action.

1.4.1 Scoping Process

The scoping process identifies the significant environmental issues relevant to disposal and reuse, and provides an opportunity for public involvement in the development of the EIS. The NOI (Appendix B) to prepare an EIS for disposal of K. I. Sawyer AFB was published in the Federal Register on October 28, 1993. Notification of public scoping was also made through local media, as well as through letters to federal, state, and local agencies and officials, and interested groups and individuals.

The scoping period for the disposal of K. I. Sawyer AFB began on October 28, 1993. A public meeting was held on May 17, 1994 at the Gwinn High School, Gwinn, Michigan, to solicit comments and concerns from the general public on the disposal and reuse of K. I. Sawyer AFB. Approximately 36 people attended the meeting. Representatives of the Air Force presented an overview of the meeting's objectives, agenda, and procedures, and described the process and purpose for the development of a disposal and reuse EIS. In addition to verbal comments, written comments were received during the scoping process. These comments, as well as information from the local community during initial scoping meetings in November 1993 and February 1994, experience with similar programs, and NEPA requirements, were used to determine the scope and direction of studies/analysis to accomplish this EIS.

1.5 ORGANIZATION OF THIS EIS

This EIS is organized into the following chapters and appendices: Chapter 2 provides a description of the Proposed Action, reasonable alternatives to the Proposed Action, and other land use concepts that have been identified for reuse of K. I. Sawyer AFB property. Chapter 2 also briefly discusses alternatives eliminated from further consideration. Finally, Chapter 2 provides a comparative summary of the effects of the Proposed Action and alternatives with respect to effects on the local community and the natural environment. Chapter 3 presents the affected environment under the

baseline conditions of base closure, providing a basis for analyzing the impacts of the Proposed Action and alternatives. When needed for analytical comparisons, a preclosure reference is provided for certain resource areas. It describes a point in time at or near the closure announcement, and depicts an active base condition. The results of the environmental analysis are presented in Chapter 4 and form the basis for the summary table at the end of Chapter 2. Chapter 5 lists individuals and organizations consulted during the preparation of the EIS; Chapter 6 provides a list of the document's preparers; Chapter 7 contains references; and Chapter 8 contains an index.

In addition to the main text, the following appendices are included in this document:

- Appendix A - a glossary of terms, acronyms, and abbreviations used in this document
- Appendix B - the NOI to prepare this disposal and reuse EIS
- Appendix C - a list of individuals and organizations who were sent a copy of the DEIS
- Appendix D - an Installation Restoration Program (IRP) bibliography and site descriptions
- Appendix E - a description of the methods used to evaluate the impacts of base reuse on resources of the local community and the environment
- Appendix F - a list of environmental permits held by K. I. Sawyer AFB
- Appendix G - a list of storage tanks, oil/water separators, pesticide storage, and solid waste management units (SWMUs) and Areas of Concern (AOCs) at K. I. Sawyer AFB
- Appendix H - Air Force policy regarding management of asbestos-containing material (ACM) at bases that are closing, and results of the K. I. Sawyer AFB asbestos survey
- Appendix I - air quality analysis methods and air emissions inventory for K. I. Sawyer AFB
- Appendix J - a detailed description of issues and assumptions related to noise effects
- Appendix K - biological resources

- Appendix L - Farmland Conversion Impact Rating Form AD-1006

- Appendix M - agency letters and certifications regarding conditions at K. I. Sawyer AFB relevant to its disposal and subsequent reuse

- Appendix N - influencing factors and environmental impacts by land use category.

1.6 FEDERAL PERMITS, LICENSES, AND ENTITLEMENTS

Representative federal permits, licenses, and entitlements that may be required of recipients of K. I. Sawyer AFB for purposes of redevelopment are presented in Table 1.6-1. The table is presented for illustrative purposes only, and does not include state or local permits, licenses, or entitlements that may be required.

Table 1.6-1. Representative Federal Permits, Licenses, and Entitlements Potentially Required for Reusers or Developers of Disposed Base Property
Page 1 of 2

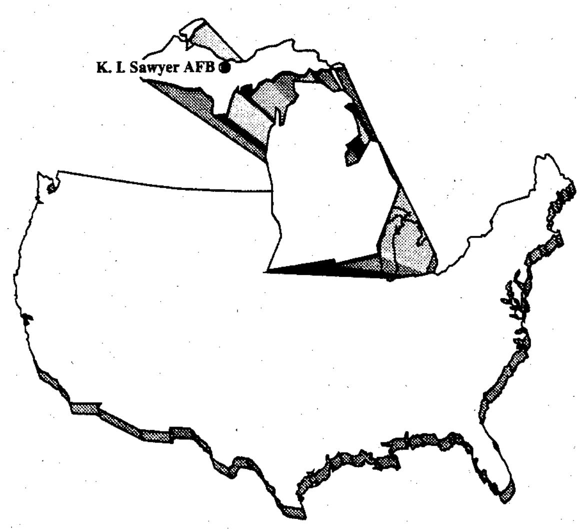
Federal Permit, License, or Entitlement	Typical Activity, Facility, or Category of Persons Required to Obtain the Federal Permit, License, or Entitlement	Authority	Regulatory Agency
Title V permit under the CAA	Any major source (source that emits more than 100 tons/year of criteria pollutant in nonattainment area for that pollutant or is otherwise defined in Title I of CAA as a major source); affected sources as defined in Title IV of CAA; sources subject to Section 111 regarding New Source Performance Standards; sources of air toxics regulated under Section 112 of CAA; sources required to have new source or modification permits under Parts C or D of Title I of CAA; and any other source designated by U.S. EPA regulations	Title V of CAA, as amended by 1990 CAA Amendments	U.S. EPA; Michigan Department of Natural Resources, Division of Air Quality
National Pollutant Discharge Elimination System permit	Discharge of pollutant from any point source into waters of the United States	Section 402 of Clean Water Act, 33 U.S.C. §1342	U.S. EPA; Michigan Department of Natural Resources
Section 404 (Dredge and Fill) permit	Any project activities resulting in the discharge of dredged or fill material into bodies of water, including wetlands, within the United States	Section 404 of Clean Water Act, 33 U.S.C. §1344	U.S. Department of Defense - Army Corps of Engineers, in consultation with U.S. EPA
Hazardous waste TSD facility permit	Owners or operators of a new or existing hazardous waste TSD facility	RCRA, as amended, 42 U.S.C. §6901; 40 CFR 270	U.S. EPA; Michigan Department of Natural Resources

CAA = Clean Air Act
CFR = Code of Federal Regulations
EPA = Environmental Protection Agency
RCRA = Resource Conservation and Recovery Act
TSD = treatment, storage, or disposal
U.S.C. = United States Code

Table 1.6-1. Representative Federal Permits, Licenses, and Entitlements Potentially Required for Reusers or Developers of Disposed Base Property
Page 2 of 2

Federal Permit, License, or Entitlement	Typical Activity, Facility, or Category of Persons Required to Obtain the Federal Permit, License, or Entitlement	Authority	Regulatory Agency
U.S. EPA identification number	Generators or transporters (off-site transport) of hazardous waste	40 CFR 262.10 (generators); 40 CFR 263, Subpart B (transporters)	U.S. EPA
Archaeological Resources Protection Act permit	Excavation and/or removal of archaeological resources from public lands or Indian lands and carrying out activities associated with such excavation and/or removal	Archaeological Resources Protection Act of 1979, 16 U.S.C. §470cc	U.S. Department of the Interior - National Park Service
Endangered Species Act §10 permit	Taking endangered or threatened wildlife species; engaging in certain commercial trade of endangered or threatened plants or removing such plants on property subject to federal jurisdiction	Section 10 of Endangered Species Act, 16 U.S.C. §1539; 50 CFR 17, Subparts C,D,F, and G.	U.S. Department of the Interior - Fish and Wildlife Service
Airport Operating Agency	Operating a land airport serving any scheduled or unscheduled passenger operation of air carrier aircraft designed for more than 30 passenger seats.	Federal Aviation Act of 1958, 49 U.S.C. App. §1432.	U.S. Department of Transportation, Federal Aviation Administration

CFR = Code of Federal Regulations
EPA = Environmental Protection Agency
U.S.C. = United States Code



CHAPTER 2
ALTERNATIVES INCLUDING THE PROPOSED ACTION

2.0 ALTERNATIVES INCLUDING THE PROPOSED ACTION

2.1 INTRODUCTION

This section describes the Proposed Action, reasonable alternatives to the Proposed Action, and the No-Action Alternative. In addition, potential conveyance of K. I. Sawyer AFB properties and facilities from the Air Force to other agencies is described as independent reuse options that are not part of a complete reuse plan. The potential environmental impacts of the Proposed Action and alternatives are summarized in table form at the end of this section.

An AFBCA Operating Location (OL) has been established at K. I. Sawyer AFB. The responsibilities of the OL and its caretaker personnel include coordinating post-closure activities with the active force closure activities, establishing a caretaker force to maintain Air Force-controlled properties after closure, and serving as the Air Force local liaison to community reuse groups until lease termination, title surrender, or disposal (as appropriate) of the Air Force-controlled property has been completed. For the purposes of environmental analysis, it was assumed that this team would consist of approximately 50 people at the time of closure, conceptually composed of 10 Air Force employees and 40 caretaker personnel. The OL, as used in this document, may refer to either the AFBCA or supporting maintenance personnel.

A private property parcel of approximately 143 acres is within the outer boundary at K. I. Sawyer AFB (see Figure 1.2-1). This parcel has been left in its natural condition and contains forest and portions of Silver Lead Creek. Because this property is a private parcel outside the control of the Air Force, it is not included within the reuse plans.

In order to address the range of potential environmental impacts of disposal and reuse, a Proposed Action, three conceptual reuse alternatives, and a No-Action Alternative have been developed:

- The **Proposed Action** centers on support for a mixed use airport with civilian aviation activities including maintenance, commercial passenger, general aviation, and air cargo components. Total flight operations would be approximately 65,088 by 2015. Other major uses would include industrial and public facilities/recreation. The plan also incorporates institutional, commercial, residential, and military land uses.

- The **International Wayport Alternative** centers on support for a mixed use airport with civilian aviation activities including maintenance, commercial passenger, general aviation, and air cargo

components. Total flight operations would be approximately 100,000 by 2015. The plan also incorporates industrial, institutional, commercial, residential, public facilities/recreation, and agricultural (forest) land uses.

- The **Commercial Aviation Alternative** focuses on a regional commercial airport and institutional training including public safety activities. Total flight operations would be 60,900 by 2015. Other major land uses would be public facilities/recreation and agriculture (forest). Smaller areas are proposed for industrial, institutional, commercial, and residential uses.

- The **Recreation Alternative** features extensive public facilities/recreation land uses. The remaining portions of the base would be redeveloped for industrial, institutional, commercial, and residential uses. This alternative does not include any airfield or aviation support uses.

- The **No-Action Alternative** would result in K. I. Sawyer AFB being placed in caretaker status with only maintenance activities taking place on the base.

In order to accomplish impact analysis, a set of general assumptions was made for each of the alternatives. These assumptions include employment and population changes arising from implementation of each reuse plan, consistent land use designations for similar reuse options, proportion of ground disturbance anticipated for each land use type, transportation and utility effects of each proposal as a function of increased population growth due to redevelopment, and anticipated phasing of the various elements of each reuse plan (as measured at the closure baseline and at the baseline plus 5, 10, and 20 years). Details regarding the generation of these assumptions are found in Appendix E, Methods of Analysis. Specific assumptions developed for individual reuse plans are identified in the discussion of each proposal within Sections 2.2 and 2.3.

During the development of alternatives addressed in the EIS, the Air Force considered the compatibility of future land uses with current site conditions that may restrict reuse activities to protect human health and the environment. These conditions include potential contamination from past releases of hazardous substances and Air Force efforts to remediate the contamination under the IRP. IRP remediation at K. I. Sawyer AFB and other environmental studies may result in lease/deed restrictions that limit reuse options at certain locations within the base. Additionally, the Air Force may retain access rights to these sites to implement IRP remediation (e.g., temporary easement for access to monitoring wells).

2.2 DESCRIPTION OF PROPOSED ACTION

Section 2905(b)(2)(E) of DBCRA requires the Air Force, as part of the disposal process, to consult with the applicable state governor, heads of local governments, or equivalent political organizations for the purposes of considering any plan for the use of such property by the concerned local community. DOD policy is to encourage timely community reuse planning by offering to use the community's plan for reuse or development of land and facilities as the Air Force's Proposed Action in the EIS.

The K. I. Sawyer Base Conversion Authority was formed as a redevelopment authority in September 1993 by the state of Michigan and given authority to redevelop K. I. Sawyer AFB. The K. I. Sawyer Base Conversion Authority has seven civilian committee members representing businesses, residents, labor, and utility services from Alger, Delta, Dickinson, Marquette, and Menominee counties; one person from the Marquette County Board of Commissioners representing Marquette County; and three township supervisors representing Sands, Forsyth, and West Branch townships.

The K. I. Sawyer Base Conversion Authority contracted with a consulting firm to assess existing land, facilities, and infrastructure on K. I. Sawyer AFB and evaluate their potential for airport and non-aviation uses. In March 1995, a Base Reuse Plan, was submitted to the Air Force by the K. I. Sawyer Base Conversion Authority (Greiner, Inc., 1995). The plan has not been adopted yet by the K. I. Sawyer AFB Base Conversion Authority, but has been used as a guideline for development of the Proposed Action. This plan addressed the following:

- Goals, objectives, and strategies
- Preliminary land uses for the year 2000
- Types of aviation uses.

As part of the reuse plan, the K. I. Sawyer Base Conversion Authority has accepted a proposal for use of portions of the base by a local Native American organization. The areas approved for reuse are within the aviation support and residential land uses. Light industrial use is proposed for the aviation support land use while approximately 422 housing units, the preschool, and shoppette would be utilized within the residential area.

The Air Force has used the community's plan in the development of the Proposed Action. This reuse plan (Figure 2.2-1) focuses on a civilian airport with air cargo, aircraft maintenance, general aviation, and regional air carrier service. Non-aviation areas would include industrial, institutional (medical and educational), commercial, residential, and public facilities/recreation uses. A small military component would include the U.S. Army Reserve and Michigan Army National Guard (MANG).

EXPLANATION

- ① Airfield
- ② Aviation Support
- ③ Industrial
- ④ Institutional (Medical)
- ⑤ Institutional (Educational)
- ⑥ Commercial
- ⑦ Residential
- ⑧ Public Facilities/ Recreation
- ⑨ Agriculture*
- ⑩ Military
- Base Boundary
- Access Point
- Proposed Access Point
- Runway

0 950 1900 3800 Feet

* Standard land use designation not applicable to this figure.

Proposed Action

Figure 2.2-1

The acreage associated with each land use category is provided in Table 2.2-1.

Table 2.2-1. Land Use Acreage - Proposed Action

Land Use	Acreage
Airfield	1,397
Aviation support	455
Industrial	1,476
Institutional	
Medical	16
Educational	8
Commercial	43
Residential	152
Public facilities/recreation	1,183
Military	193
Total	4,923

Consistent with the K. I. Sawyer Base Conversion Authority plan, the following types of assumptions were developed to supplement the Proposed Action:

- Industrial land uses
- Projected fleet mix and flight operations
- Closure of Marquette County Airport and transfer of operations to K. I. Sawyer AFB
- Airport boundary
- Amount of development (i.e., demolition, new construction)
- Acreages of each land use disturbed by construction and demolition activities
- Phasing of plans for reuse
- Project-related employment and population projections
- Traffic generation

- Projected utility use

- Underground aircraft hydrant fueling system would be abandoned.

The amount of potential development through 2015, including demolition, retention, and new construction for each land use under the Proposed Action, is provided in Table 2.2-2. It should be noted, however, that existing (retained) facilities may not be fully utilized during the 20-year study period.

Table 2.2-2. Facility Development - Proposed Action

Land Use	Existing Facility Demolition	Existing Facility Retention	New Facility Construction
	(thousands of square feet of floor space)		
Airfield	0	0	0
Aviation support	2	478	228
Industrial	2,199	808	3,601
Institutional			
Medical	0	120	0
Educational	13	43	0
Commercial	0	310	0
Residential	0	802	0
Public facilities/recreation	0	582	0
Military	0	60	0
Total	2,214	3,203	3,829

The acreage within each land use that is assumed to be disturbed by construction of facilities, infrastructure improvements, or other operational activities under the Proposed Action is provided in Table 2.2-3 for three phases of development: 1995-2000, 2000-2005, and 2005-2015. The sections below describe activities associated with each land use category.

2.2.1 Airfield

The airfield comprises 1,397 acres, or 28 percent of the base area, and would include the 12,300-foot by 300-foot runway, taxiways, and runway protection zones (RPZs).

The RPZs are areas at the ends of the runway that are kept free of development, except for navigational aids, for added safety during aircraft arrivals and departures. The existing operational apron is adequate for use by the projected aircraft. Within the airfield land use, an area has been

Table 2.2-3. Acres Disturbed - Proposed Action

Land Use	Acres Disturbed (by phase) 1995-2000	2000-2005	2005-2015	Total
Airfield	0	0	0	0
Aviation support	14	14	28	56
Industrial	155	155	310	620
Institutional				
Medical	0	0	0	0
Educational	1	0	0	1
Commercial	0	0	0	0
Residential	1	1	2	4
Public facilities/recreation	0	0	0	0
Military	0	0	0	0
Total	171	170	340	681

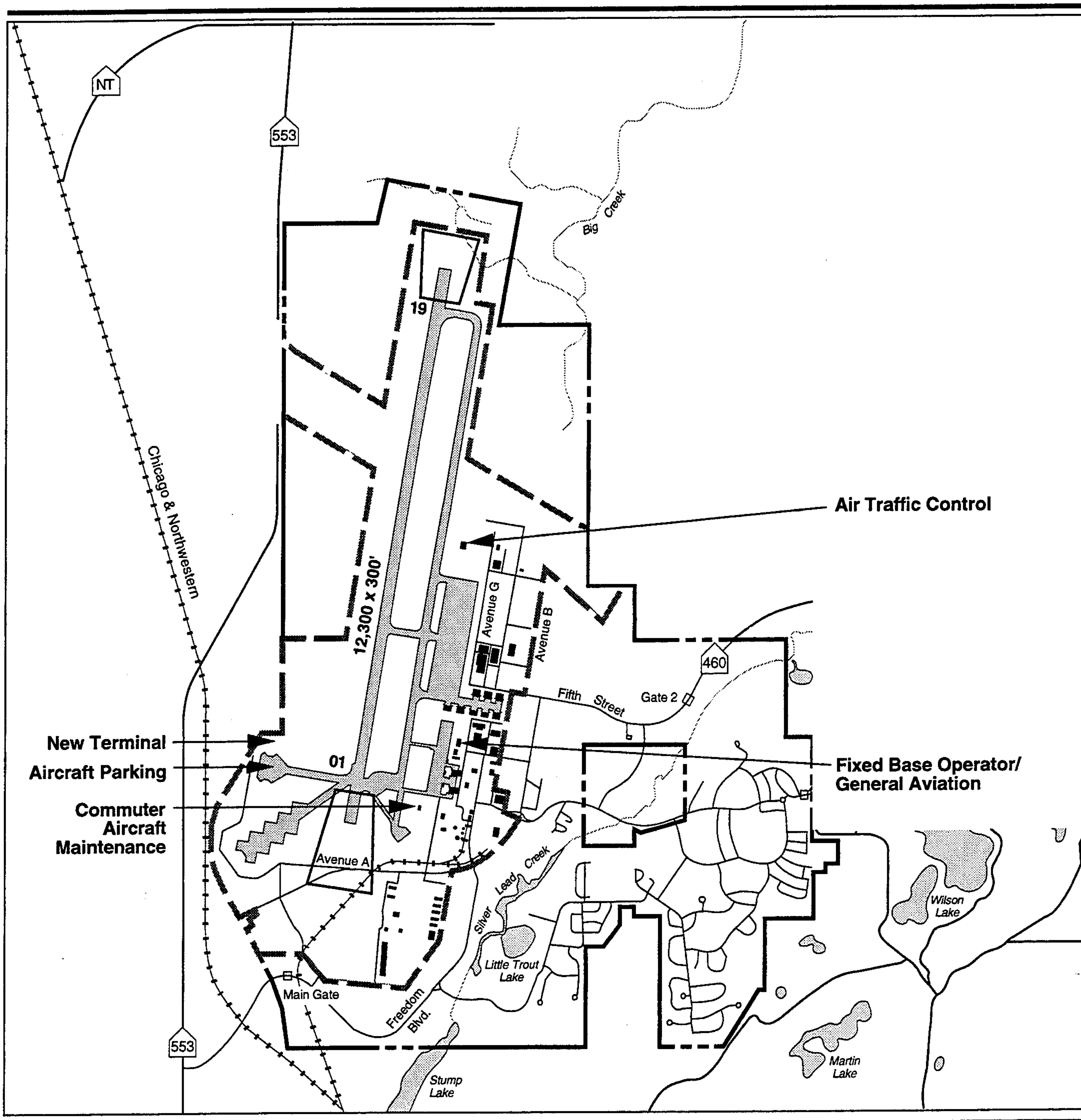
included for the addition of a crosswind runway. Construction of the crosswind runway would take place between 2015 and 2020.

A preliminary airport plan (Figure 2.2-2) for the civilian reuse of the aviation facilities as a primarily commercial transport airport at K. I. Sawyer AFB was developed to serve the central Upper Peninsula region. The concept is based on Marquette County Airport closing and the transfer of existing air services and operations from the airport to K. I. Sawyer AFB.

The airport layout characteristics related operations (e.g., runway/taxiway dimensions, separations, clearances) were developed using the FAA Airport Design Advisory Circular 150/5300-13. The airport area in this layout includes aviation and non-aviation land uses that may generate revenue for financial support of the airport. The following major improvements to the airfield would occur:

- Provision for crash, fire, and rescue facilities
- Construction of a new passenger terminal on the west side of the main runway north of the alert aprons
- Modification of the lighting system and approach aids
- Retention of very high-frequency omnidirectional range (VOR) facilities.

Additional airport improvements would be made to meet FAA requirements. The airfield and aviation support areas would likely be conveyed to an airport



EXPLANATION

Airport Boundary

Airfield Pavement

Runway Protection Zone

Base Boundary

0 950 1900 3800 Feet

Preliminary Airport Plan - Proposed Action

Figure 2.2-2

authority, which would manage the development and operation of the airfield in accordance with the FAA and state regulations. The existing underground aircraft hydrant fueling system would be abandoned in place or removed.

Projected annual aircraft operations related to the aviation activities at K. I. Sawyer AFB are provided in Table 2.2-4 for 2000, 2005, and 2015. An operation is defined as one aircraft landing or one takeoff. Based on historic weather and wind patterns, up to 70 percent of the projected aircraft operations would use Runway 01, while the remaining 30 percent would use Runway 19. Projected annual aircraft operations would include general aviation, regional commercial passenger, air cargo, and maintenance. Projected transient aircraft operations are assumed to be in support of these four major aviation user groups and are included in the operations projections totals. It was assumed that a small number of military aircraft, mostly Canadian, would continue to use the airfield as a fueling point between the East and West coasts. A full-service Fixed Base Operator (FBO) would be established at the airport to provide general aviation services.

According to federal law, all non-military jet traffic operating in the United States weighing more than 75,000 pounds must conform to Stage 3 noise standards by 2000. Therefore, in each of the planning years, all jet aircraft projected to operate from K. I. Sawyer AFB will meet Stage 3 noise standards. The remaining aircraft, which include the multi-engine piston and turboprop aircraft utilized by the regional air carriers mostly transferring from Marquette County Airport, are not subject to Stage 3 regulations.

For analysis purposes, 94 percent of the aircraft operations in each of the planning years are projected to occur between 7:00 a.m. and 10:00 p.m.; the remaining 6 percent would occur between 10:00 p.m. and 7:00 a.m.

The flight tracks utilized by K. I. Sawyer AFB aircraft to transition to and from the area airspace will be eliminated upon closure. New flight tracks consisting of a straight arrival/departure path to each end of the main runway would be instituted. Additionally, a closed left and right traffic pattern would be created.

2.2.2 Aviation Support

The aviation support area encompasses 455 acres, or 9 percent of the base property, and consists of three parcels. The first parcel, east of the runway, includes the existing ATC tower, the flight simulator, an eight-bay fire station, aircraft maintenance hangars, and storage buildings. The ATC

Table 2.2-4. K. I. Sawyer AFB Projected Flight Operations - Proposed Action
Page 1 of 2

Year	Operation	Function	Percent	Fleet Mix[a]	Annual Operations[b]
2000	Air cargo	Cargo	3	757[c]	1,500
			2	MD-11[c]	1,000
			1	747-400[c]	500
	Aircraft maintenance	Maintenance	0.7	Beech 1900	300
			0.7	ATR-42	300
	Regional	Air carrier	6	Beech 1900	2,552
			0.6	Saab 340	232
			18	ATR-42	8,352
			1	ATR-72	464
	General aviation	Private aircraft	51	Single engine	23,700
			11	Multi-engine	5,000
			2	Turboprop	1,000
			2	Turbojet	1,000
	Military	Transient	0.3	CF-5	96
			0.1	CT-33	13
			0.1	CF/FA-18	25
			0.2	CT-114	70
			0.2	F-16	50
			0.1	UH-1	34
				Total	46,188
2005	Air cargo	Cargo	2	757[c]	1,000
			2	MD-11[c]	1,000
			2	747-400[c]	1,000
	Aircraft maintenance	Maintenance	0.6	Beech 1900	300
			0.6	ATR-42	300
			0.2	ATR-72	150
	Regional	Air carrier	5	Beech 1900	2,600
			1	Saab 340	650
			17	ATR-42	9,100
			1	ATR-72	650
	General aviation	Private aircraft	51	Single engine	26,500
			12	Multi-engine	6,300
			3	Turboprop	1,300
			2	Turbojet	1,000
	Military	Transient	0.1	CF-5	96
			0.1	CT-33	13
			0.1	CF/FA-18	25
			0.1	CT-114	70
			0.1	F-16	50
			0.1	UH-1	34
				Total	52,138

Notes: (a) Typical projected air cargo and regional aircraft types.
(b) An aircraft operation is one takeoff or one landing.
(c) Aircraft with Stage 3 engines.

Table 2.2-4. K. I. Sawyer AFB Projected Flight Operations - Proposed Action
Page 2 of 2

Year	Operations	Function	Percent	Fleet Mix[a]	Annual Operations[b]
2015	Air cargo	Cargo	1	757[c]	500
			2	MD-11[c]	1,000
			2	747-400[c]	1,500
	Aircraft maintenance	Maintenance	0.2	Beech 1900	150
			0.7	ATR-42	450
			0.5	ATR-72	300
	Regional	Air carrier	4	Beech 1900	2,325
			2	Saab 340	1,085
			16	ATR-42	10,540
			2	ATR-72	1,550
	General aviation	Private aircraft	52	Single engine	34,000
			13	Multi-engine	8,500
			3	Turboprop	1,700
			1	Turbojet	1,200
	Military	Transient	0.1	CF-5	96
			0.1	CT-33	13
			0.1	CF/FA-18	25
			0.1	CT-114	70
			0.1	F-16	50
			0.1	UH-1	34
				Total	65,088

Notes: (a) Typical projected air cargo and regional aircraft types.
(b) An aircraft operation is one takeoff or one landing.
(c) Aircraft with Stage 3 engines.

tower operation would continue, with operation and maintenance being provided by the K. I. Sawyer Base Conversion Authority. The second parcel, southeast of the runway, includes the aircraft fuel storage area.

The third parcel, west of the southern end of the airfield, includes the north alert apron and adjacent vacant land. Reuse of this parcel would include a new 25,500-square-foot commercial passenger terminal, which would be constructed north of the existing alert apron. A new access road and 188,000 square feet of parking would also be constructed for the new terminal. New aviation fuel storage tanks would be installed in the aviation support area. As part of the reuse development of the base, the K. I. Sawyer Base Conversion Authority has accepted a proposal for use of portions of the base by a local Native American organization within the aviation support land use for light industrial use. The existing aviation support facilities would be 70 percent utilized by 2015.

2.2.3 Industrial

The industrial area is 1,476 acres, or 30 percent of the base property, and includes eight parcels. Three parcels west of the airfield would be used for light industrial with supporting commercial activities. Two parcels east of the airfield, including the Weapons Storage Area, would also be used for light industrial and commercial activities. Three parcels in the east and southeast portions of the base would be used for heavy industrial development. The existing housing units would be demolished to allow for this reuse. All industrial development would begin in 1995 and would be 70 percent complete by 2015.

2.2.4 Institutional

The institutional land use encompasses 24 acres, or 1 percent of the base property, and includes medical and educational uses in two parcels. The medical land use includes the base hospital, which would be reused as a medical clinic within the first 5 years after closure.

The educational parcel includes the Jack and Jill Center, Youth Center, and Child Development Center, which would continue with the same uses. The educational land use would be 100 percent complete by 2000.

2.2.5 Commercial

Commercial uses comprise 43 acres, or 1 percent of the base, in three parcels east of the airfield. The northernmost parcel includes the Accounting and Finance and four other administrative buildings. The center parcel includes three small buildings. The southern parcel includes base engineering, Scheduled Airlines Ticket Office, the education center, personnel office building, and Wing Headquarters. Reuse would include office and back office uses. Commercial development would be 100 percent complete by 2015.

2.2.6 Residential

Residential areas cover 152 acres, or 3 percent of the base, in one parcel. This parcel, adjacent to Gate 3, includes 422 housing units, the preschool, and shoppette. These residential units are projected to be 100 percent occupied by 2015.

2.2.7 Public Facilities/Recreation

The public facilities/recreation area includes 1,183 acres, or 24 percent of the base property. The golf course, community recreation areas near Little Trout Lake, ball fields, and indoor facilities, such as the bowling center, gymnasium, and swimming pool, would be retained for public use. In

addition, the small arms firing range in the southern portion of the base would continue to be used for small arms training. No demolition or new construction is proposed for the recreation area. Public facilities/recreation reuse would commence immediately after base reuse is initiated.

2.2.8 Military

Military land use would occupy 193 acres, or 4 percent of the base, in three parcels west of the airfield. These parcels would be used by the MANG and the U.S. Army Reserve for operations, training, and storage of equipment. Reuse would commence immediately after base closure.

2.2.9 Employment and Population

By 2015, the Proposed Action would generate site-related employment of 9,903 direct jobs (Table 2.2-5). A total of 1,182 persons would live on base.

Table 2.2-5. Site-Related Employment and Population - Proposed Action

	Closure	2000	2005	2015
Direct employment	50	2,718	5,114	9,903
On-base population	0	295	591	1,182

2.2.10 Transportation

Existing access roads to base property would continue to be used (see Figure 2.2-1). In addition, a new base access road utilizing an old section of County Road (CR) 553 would be constructed from CR 553 to the new passenger terminal and adjacent industrial area. Also, a new access road from CR 553 to the industrial parcel in the northwest corner of the base would be constructed. Based on land use and employment projections, this alternative would generate an average of 33,950 vehicle trips daily by 2015. Most vehicular traffic would occur during daylight hours.

2.2.11 Utilities

By 2015, the projected activities associated with the Proposed Action would generate the following total utility usage:

- Water - 2.4 million gallons per day (MGD)
- Wastewater - 0.8 MGD
- Solid waste - 21 tons per day

- Electricity - 151 megawatt-hours (MWH) per day
- Natural gas - 1.3 million cubic feet (MMCF) per day.

2.3 DESCRIPTION OF ALTERNATIVES

2.3.1 International Wayport Alternative

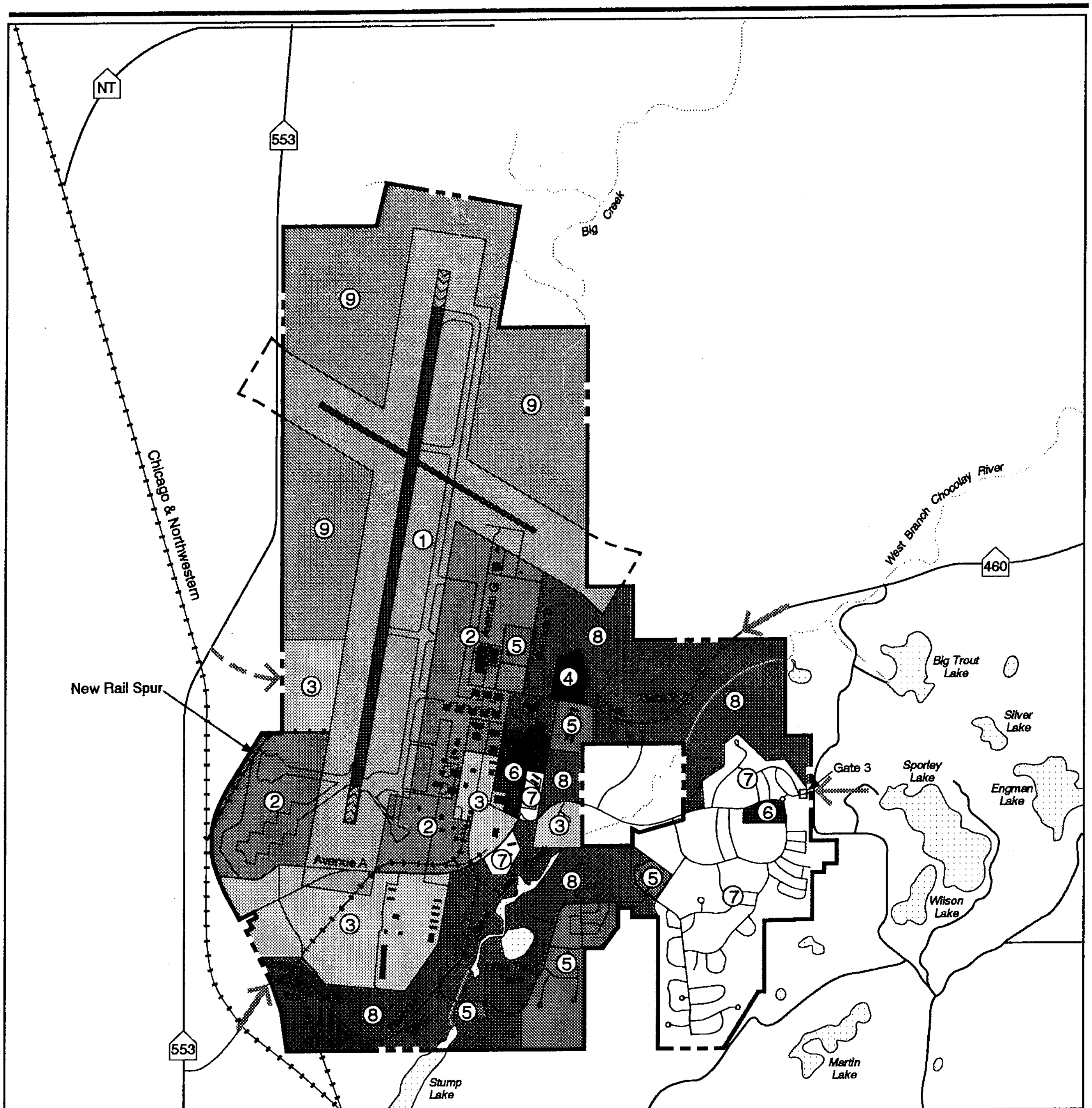
The land uses presented in the International Wayport Alternative (Figure 2.3-1) provide a framework for development of a comprehensive reuse plan based on a multipurpose airport with international and regional aircraft maintenance, commercial passenger, air cargo, and general aviation services. Non-aviation uses would consist of industrial, institutional (medical and educational), commercial, residential, public facilities/recreation, and agriculture. The acreage associated with each land use category is provided in Table 2.3-1.

Table 2.3-1. Land Use Acreage - International Wayport Alternative

Land Use	Acreage
Airfield	1,055
Aviation support	617
Industrial	495
Institutional	
Medical	24
Educational	138
Commercial	64
Residential	538
Public facilities/recreation	1,118
Agriculture	874
Total	4,923

The following types of assumptions were used to develop the International Wayport Alternative:

- Land uses and land use acreage
- Projected fleet mix and flight operations
- Closure of Marquette County Airport and transfer of operations to K. I. Sawyer AFB
- Airport boundary
- Amount of development (i.e., demolition, new construction)



EXPLANATION

1 Airfield	5 Institutional (Educational)	9 Agriculture
2 Aviation Support	6 Commercial	Base Boundary
3 Industrial	7 Residential	Access Point
4 Institutional (Medical)	8 Public Facilities/ Recreation	Proposed Access Point
		Runway

0 950 1900 3800 Feet

International Wayport Alternative

Figure 2.3-1

- Acreages of each land use disturbed by construction and demolition activities

- Phasing of plans for reuse

- Project-related employment and population projections

- Traffic generation and required access points

- Projected utility use.

The amount of potential development through 2015, including demolition, retention, and new construction for each land use under the International Wayport Alternative, is provided in Table 2.3-2. It should be noted, however, that existing (retained) facilities may not be fully utilized during the 20-year study period.

Table 2.3-2. Facility Development - International Wayport Alternative

Land Use	Existing Facility Demolition	Existing Facility Retention	New Facility Construction
	(thousands of square feet of floor space)		
Airfield	0	0	0
Aviation support	152	742	446
Industrial	13	472	701
Institutional			
Medical	0	120	0
Educational	0	701	0
Commercial	32	288	13
Residential	1	2,844	0
Public facilities/recreation	0	50	0
Agriculture	1	1	0
Total	199	5,218	1,160

The acreage within each land use, which is assumed to be disturbed by construction of facilities, infrastructure improvements, or other operational activities under the International Wayport Alternative, is provided in Table 2.3-3 for three phases of development: 1995-2000, 2000-2005, and 2005-2015. The sections below describe activities associated with each land use category.

Table 2.3-3. Acres Disturbed - International Wayport Alternative

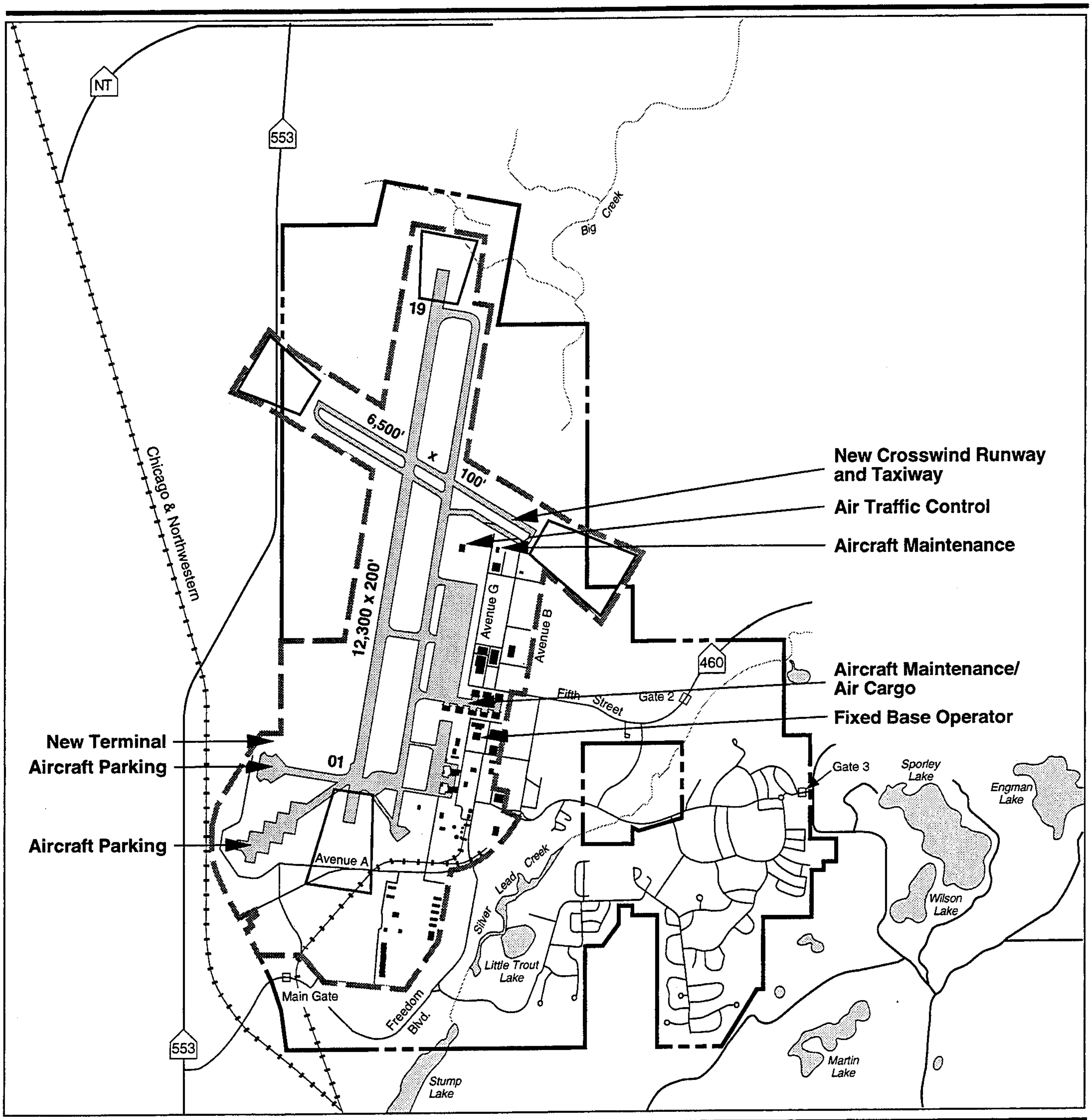
Land Use	Acres Disturbed (by phase) 1995-2000	2000-2005	2005-2015	Total
Airfield	0	0	94	94
Aviation support	36	17	21	74
Industrial	34	29	58	121
Institutional				
Medical	0	0	0	0
Educational	0	0	0	0
Commercial	1	1	1	3
Residential	0	0	0	0
Public facilities/recreation	0	0	0	0
Agriculture	88	0	0	88
Total	159	47	174	380

2.3.1.1 Airfield. The airfield comprises 1,055 acres, or 21 percent of the base area, and would contain a 12,300-foot by 200-foot runway, taxiways, a new crosswind runway and taxiway, and RPZs. The crosswind runway would be constructed after 2005. The existing operational apron is adequate for use by the projected aircraft.

A preliminary airport plan (Figure 2.3-2) for the civilian reuse of the aviation facilities at K. I. Sawyer AFB was developed around the concept of an international wayport. The international wayport concept is based on several well positioned international airports being developed in rural, unpopulated areas of North America that have major sections of unused airspace. The proposed K. I. Sawyer AFB International Wayport would provide an international transfer point for both scheduled passengers and air cargo flights from major cities located in eastern Europe and Asia.

The airport layout characteristics related to large international aircraft operations (e.g., runway/taxiway dimensions, separations, clearances) were developed using the FAA Airport Design Advisory Circular 150/5300-13. The airport area in this layout includes aviation and non-aviation land uses that may generate revenue for financial support of the airport. The following major improvements to the airfield would occur:

- Construction of a 6,500-foot by 100-foot crosswind runway and associated taxiway. Acquisition of off-base avigation easements to support use of crosswind runway



EXPLANATION

Airport Boundary

Airfield Pavement

Runway Protection Zone

Base Boundary

0 950 1900 3800 Feet

Preliminary Airport Plan - International Wayport Alternative

Figure 2.3-2

- Construction of a new passenger terminal on the west side of the main runway north of the alert aprons

- Installation of Category III Precision Instrument Landing System (ILS) and Precision Approach Path Indicators (PAPIs) on Runway 01/19

- Retention or replacement of the Radar Approach Control (RAPCON) facility and installation of an automated international weather observation station.

Additional airport improvements would be made to meet FAA requirements. The airfield and aviation support areas would likely be conveyed to an airport authority, which would manage the development and operation of the airfield in accordance with the FAA and state regulations. The existing underground aircraft hydrant fueling system would be abandoned in place or removed.

Projected annual aircraft operations related to the aviation activities at K. I. Sawyer AFB are provided in Table 2.3-4 for 2000, 2005, and 2015. Based on historic weather and wind patterns, up to 70 percent of the projected aircraft operations would use Runway 01, while the remaining 30 percent would use Runway 19. Aircraft operations on the crosswind runway would be 30 percent on Runway 12 and 70 percent on Runway 30. Projected annual aircraft operations include general aviation, commercial passenger, air cargo, and maintenance. Projected transient aircraft operations are assumed to be in support of these four major aviation user groups and are included in the operations projections totals. It was assumed that a small number of military aircraft, mostly Canadian, would continue to use the airfield as a fueling point between the East and West coasts. A full-service FBO would be established at the airport to provide general aviation services.

According to federal law, all non-military jet traffic operating in the United States weighing more than 75,000 pounds must conform to Stage 3 noise standards by 2000. Therefore, in each of the planning years, all jet aircraft projected to operate from K. I. Sawyer AFB will meet Stage 3 noise standards. The remaining aircraft, which include the multi-engine piston and turboprop aircraft utilized by the regional air carriers mostly transferring from Marquette County Airport, are not subject to Stage 3 regulations.

For analysis purposes, 85 percent of the aircraft operations in each of the planning years are projected to occur between 7:00 a.m. and 10:00 p.m.; the remaining 15 percent would occur between 10:00 p.m. and 7:00 a.m.

The flight tracks utilized by K. I. Sawyer AFB aircraft to transition to and from the area airspace will be eliminated upon closure. New flight tracks consisting of a straight arrival/departure path to each end of the main

Table 2.3-4. K. I. Sawyer AFB Projected Flight Operations - International Wayport Alternative
Page 1 of 2

Year	Operations	Function	Percent	Fleet Mix[a]	Annual Operations[b]
2000	International wayport	Air cargo	1	747-400[c]	600
			3	MD-11[c]	1,200
			3	757[c]	1,200
		Air carrier	4	747-400[c]	2,000
			1	MD-11[c]	500
			9	757(c)	4,000
		Maintenance	0.6	747-400[c]	250
			0.6	MD-11[c]	250
			2	757[c]	500
	Regional	Air carrier	4	737-400	2,000
			3	S-2000	1,512
			0	Metro 3,4	0
	General aviation	Private aircraft	53	Single engine	23,700
			11	Multi-engine	5,000
			2	Turboprop	1,000
			2	Turbojet	1,000
	Military	Transient	0.2	CF-5	96
			0.1	CT-33	13
			0.1	CF/FA-18	25
			0.2	CT-114	70
			0.1	F-16	50
			0.1	UH-1	34
				Total	45,000
2005	International wayport	Air cargo	3	747-400[c]	1,900
			5	MD-11[c]	3,800
			5	757[c]	3,800
		Air carrier	4	747-400[c]	3,130
			2	MD-11[c]	1,222
			9	757[c]	6,260
		Maintenance	0.7	747-400[c]	500
			0.7	MD-11[c]	500
			1	757[c]	1,000
	Regional	Air carrier	4	737-400	3,000
			8	S-2000	6,000
			8	Metro 3,4	6,000
	General aviation	Private aircraft	37	Single engine	26,500
			9	Multi-engine	6,300
			2	Turboprop	1,300
			1	Turbojet	1,000
	Military	Transient	0.1	CF-5	96
			0.1	CT-33	13
			0.1	CF/FA-18	25
			0.1	CT-114	70
			0.1	F-16	50
			0.1	UH-1	34
				Total	72,500

Notes: (a) Typical projected international and regional aircraft types.
(b) An aircraft operation is one takeoff or one landing.
(c) Aircraft with Stage 3 engines.

Table 2.3-4. K. I. Sawyer AFB Projected Flight Operations - International Wayport Alternative
Page 2 of 2

Year	Operations	Function	Percent	Fleet Mix[a]	Annual Operations[b]
2015	International wayport	Air cargo	3	747-400[c]	2,600
			5	MD-11[c]	5,200
			5	757[c]	5,200
		Air carrier	5	747-400[c]	4,800
			2	MD-11[c]	1,600
			9	757[c]	9,600
		Maintenance	0.7	747-400[c]	750
			0.7	MD-11[c]	750
			1	757[c]	1,500
	Regional	Air carrier	5	737-400	5,000
			9	S-2000	8,656
			9	Metro 3,4	8,656
	General aviation	Private aircraft	34	Single engine	34,000
			8	Multi-engine	8,500
			2	Turboprop	1,700
			1	Turbojet	1,200
	Military	Transient	0.1	CF-5	96
			0.1	CT-33	13
			0.1	CF/FA-18	25
			0.1	CT-114	70
			0.1	F-16	50
			0.1	UH-1	34
				Total	100,000

Notes: (a) Typical projected international and regional aircraft types.
(b) An aircraft operation is one takeoff or one landing.
(c) Aircraft with Stage 3 engines.

runway and crosswind runway would be instituted. Additionally, a closed left and right traffic pattern would be created for each runway.

2.3.1.2 Aviation Support. The aviation support area encompasses 617 acres, or 13 percent of the base property, and consists of two parcels. The first parcel is located east of the runway. This parcel includes the ATC tower, aircraft fuel storage area, the flight simulator, eight-bay fire station, aircraft maintenance hangars, and storage buildings.

Aircraft maintenance operations and air cargo handling would be located in the existing B-52 aircraft maintenance complex, which contains over 200,000 square feet of floor space and is in the central portion of the aprons east of the main runway. This area includes eight large aircraft

maintenance hangars and six associated aircraft parts and equipment storage buildings. Aviation-compatible manufacturing uses may also be located within this parcel. The base operations building and an apron east of the runway would be utilized by the aircraft fueling contractor and the airfield maintenance staff. New aviation fuel storage tanks would be installed in the aviation support area.

The second parcel, west of the southern end of the airfield, includes the alert aprons. Reuse of this parcel would include construction of a new 65,000-square-foot commercial passenger terminal in the vicinity of the existing alert aprons. A new access road and parking lot would be constructed to support the proposed passenger terminal. The southern alert apron could be used to park aircraft such as cargo carriers.

The aviation support facilities would be approximately 40 percent utilized by 2015.

2.3.1.3 Industrial. The proposed industrial area is approximately 495 acres, or 10 percent of the base property, and includes four parcels. One parcel surrounds the southern portion of the airfield and contains the Weapons Storage Area. The second parcel includes the maintenance and storage buildings southeast of the main runway. The third industrial parcel includes the wastewater treatment plant (WWTP) in the southeastern portion of the base. The fourth industrial parcel, west of the airfield runway, does not include any buildings. These industrial parcels would be utilized for diversified industrial use, such as manufacturing and warehousing. Industrial development would begin in 1995 and would be approximately 70 percent complete by 2015.

2.3.1.4 Institutional. The institutional land use is approximately 162 acres, or 3 percent of the base property, and includes both medical and educational land uses distributed throughout the southeastern quadrant of the base.

The medical land use includes the base hospital, which would be reused as a medical clinic within the first 5 years after closure.

The educational land use includes five separate parcels, which would be used for vocational/technical training and support, and public educational purposes for approximately 500 students. The first parcel, west of the hospital, includes the communications facility and an administrative building, and could be used for vocational classroom and administrative functions. The second parcel, immediately south of the hospital, includes a dormitory complex that would be used to house up to 375 students. The third parcel includes 198 housing units and would be utilized for married students and instructor housing. A fourth parcel includes the small arms firing range, which would be used for security and public safety training. The fifth parcel includes the K. I. Sawyer AFB Elementary School, which would continue to

be utilized by the Gwinn Area Community Schools for public educational purposes. The educational reuse would be 100 percent complete by 2000.

2.3.1.5 Commercial. Commercial uses comprise 64 acres, or 1 percent of the base, in two parcels. The first parcel is in the central portion of the base and includes the Commissary, Base Exchange, theater, and library. Reuse would include neighborhood commercial development and office uses or uses such as telecommunications, casino gaming, or a conference center. The second parcel, in the residential area, would include the service station, Child Care Center, Youth Center, and chapel. Reuse would be similar to present uses. Commercial development would be 100 percent complete by 2015.

2.3.1.6 Residential. Residential areas cover 538 acres, or 11 percent of the base, in three parcels. Two parcels are in the central portion of the base and include the Visiting Officers' Quarters (VOQ) and Visiting Airmen's Quarters (VAQ), which would continue to be used for residential uses to house up to 385 people. These units would be 100 percent occupied by 2000. The other parcel includes 1,471 housing units, which would be utilized for permanent residential housing. These residential units are projected to be 100 percent occupied by 2015.

2.3.1.7 Public Facilities/Recreation. The public facilities/recreation area includes 1,118 acres, or 23 percent of the base property. The golf course, community recreation areas near Little Trout Lake, ball fields, and indoor facilities such as the bowling center, gymnasium, and swimming pool would be retained for public use. The Silver Lead Creek riparian area would be used for recreational purposes. No demolition or new construction is proposed for the recreation areas. Public facilities/recreation reuse would commence immediately after base closure.

2.3.1.8 Agriculture. Agricultural land occupies 874 acres, or 18 percent of the base, surrounding the northern section of the airfield. The area would be used for timber production that would commence immediately after base closure. It is anticipated that timber production may occur at least once within the 20-year analysis period.

2.3.1.9 Employment and Population. By 2015, the International Wayport Alternative would generate site-related employment of 3,894 direct jobs (Table 2.3-5). A total of 5,433 persons would reside in the dormitories and the residences.

2.3.1.10 Transportation. Existing access roads to base property would continue to be used (see Figure 2.3-1). In addition, a new base access road would be constructed from CR 553 to the new passenger terminal and industrial area. Based on land use and employment projections, this

Table 2.3-5. Site-Related Employment and Population - International Wayport Alternative

	Closure	2000	2005	2015
Direct employment	50	1,539	2,386	3,894
On-base population[a]	0	3,181	4,082	5,433

Note: (a) Includes students.

alternative would generate an average of 30,400 vehicle trips daily by 2015. Most vehicular traffic would occur during the daylight hours.

2.3.1.11 Utilities. By 2015, the projected activities associated with the International Wayport Alternative would generate the following total utility usage:

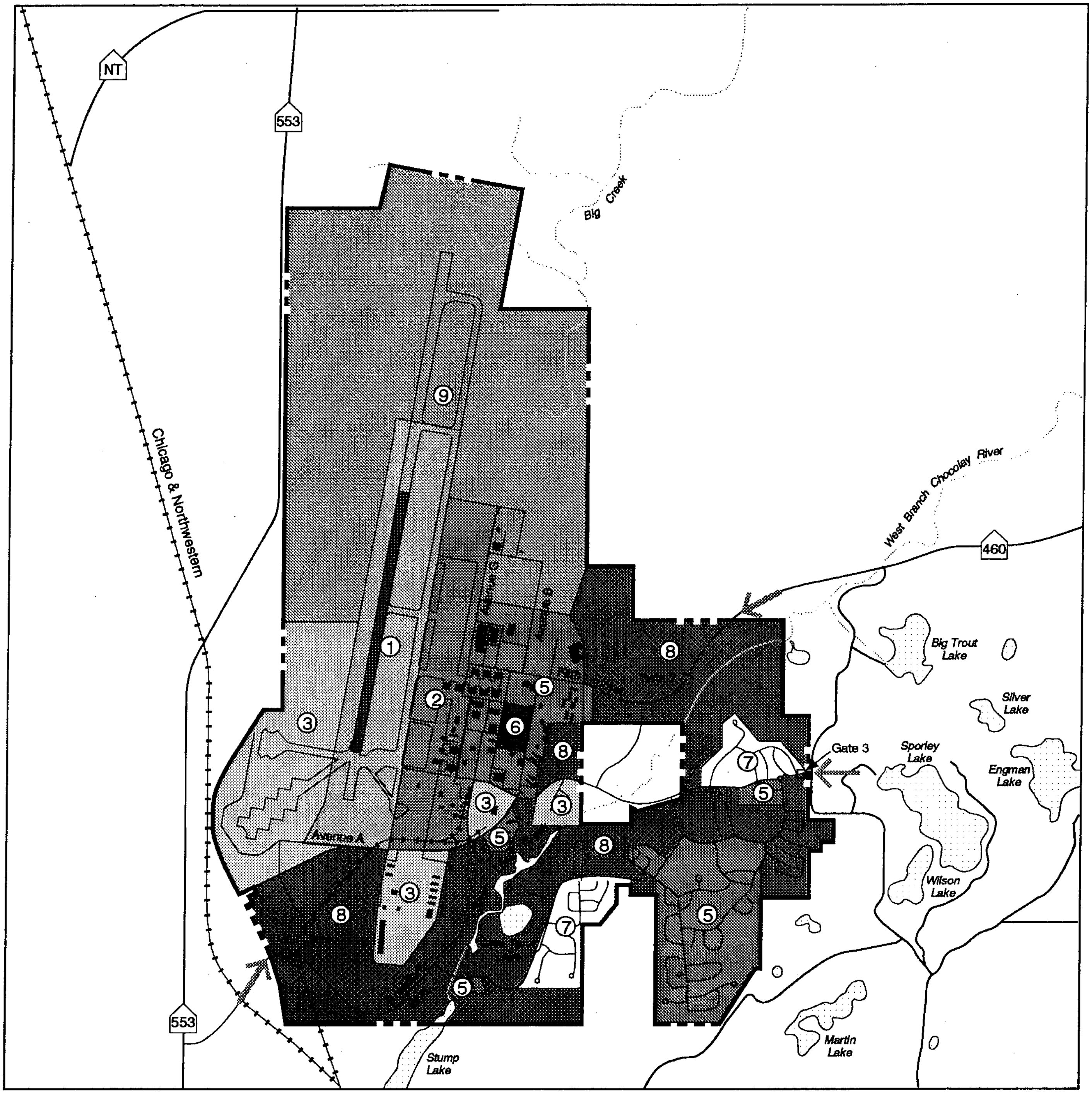
- Water - 0.9 MGD
- Wastewater - 0.8 MGD
- Solid waste - 21 tons per day
- Electricity - 133 MWH per day
- Natural gas - 1.1 MMCF per day.

2.3.2 Commercial Aviation Alternative

The Commercial Aviation Alternative (Figure 2.3-3) proposes a regional commercial airport with an Upper Peninsula vocational/educational training facility. Areas are proposed for airfield, aviation support, industrial, institutional (educational), commercial, residential, public facilities/recreation, and agriculture uses. The total acreage for each land use category is shown in Table 2.3-6.

Table 2.3-6. Land Use Acreage - Commercial Aviation Alternative

Land Use	Acreage
Airfield	510
Aviation support	325
Industrial	494
Institutional	
Educational	546
Commercial	25
Residential	147
Public facilities/recreation	1,387
Agriculture	1,489
Total	4,923



EXPLANATION

- 1 Airfield
- 2 Aviation Support
- 3 Industrial
- 4 Institutional (Medical) *
- 5 Institutional (Educational)
- 6 Commercial
- 7 Residential
- 8 Public Facilities/ Recreation
- 9 Agriculture
- Base Boundary
- Access Point
- Runway

0 950 1900 3800 Feet

* Standard land use designation not applicable to this figure.

Commercial Aviation Alternative

Figure 2.3-3

The following types of assumptions were used to develop the Commercial Aviation Alternative:

- Land uses and land use acreage
- Projected fleet mix and flight operations
- Closure of Marquette County Airport and transfer of operations to K. I. Sawyer AFB
- Airport boundary
- Amount of development (i.e., demolition, new construction)
- Acreages of each land use disturbed by construction and demolition activities
- Phasing of plans for reuse
- Project-related employment and population projections
- Traffic generation and required access points
- Projected utility use.

The amount of development through 2015, including existing facility demolition, facility retention, and new facility construction for each land use under the Commercial Aviation Alternative, is provided in Table 2.3-7. Existing (retained) facilities may not be fully utilized during the 20-year study period.

Table 2.3-8 summarizes acreages assumed to be disturbed by construction or other operational activities during each phase of development. The sections below describe activities associated with each land use category.

2.3.2.1 Airfield. The airfield comprises 510 acres, or 10 percent of the base area, and would contain the southern portion of the 12,300-foot by 300-foot runway, taxiways, and RPZs. The existing operational apron is adequate for use by the projected aircraft.

A preliminary airport plan (Figure 2.3-4) for the civilian reuse of the aviation facilities at K. I. Sawyer AFB was developed around the concept of general aviation airport with commercial service. The annual aircraft operations projections assume the transfer of all Marquette County Airport operations to K. I. Sawyer AFB.

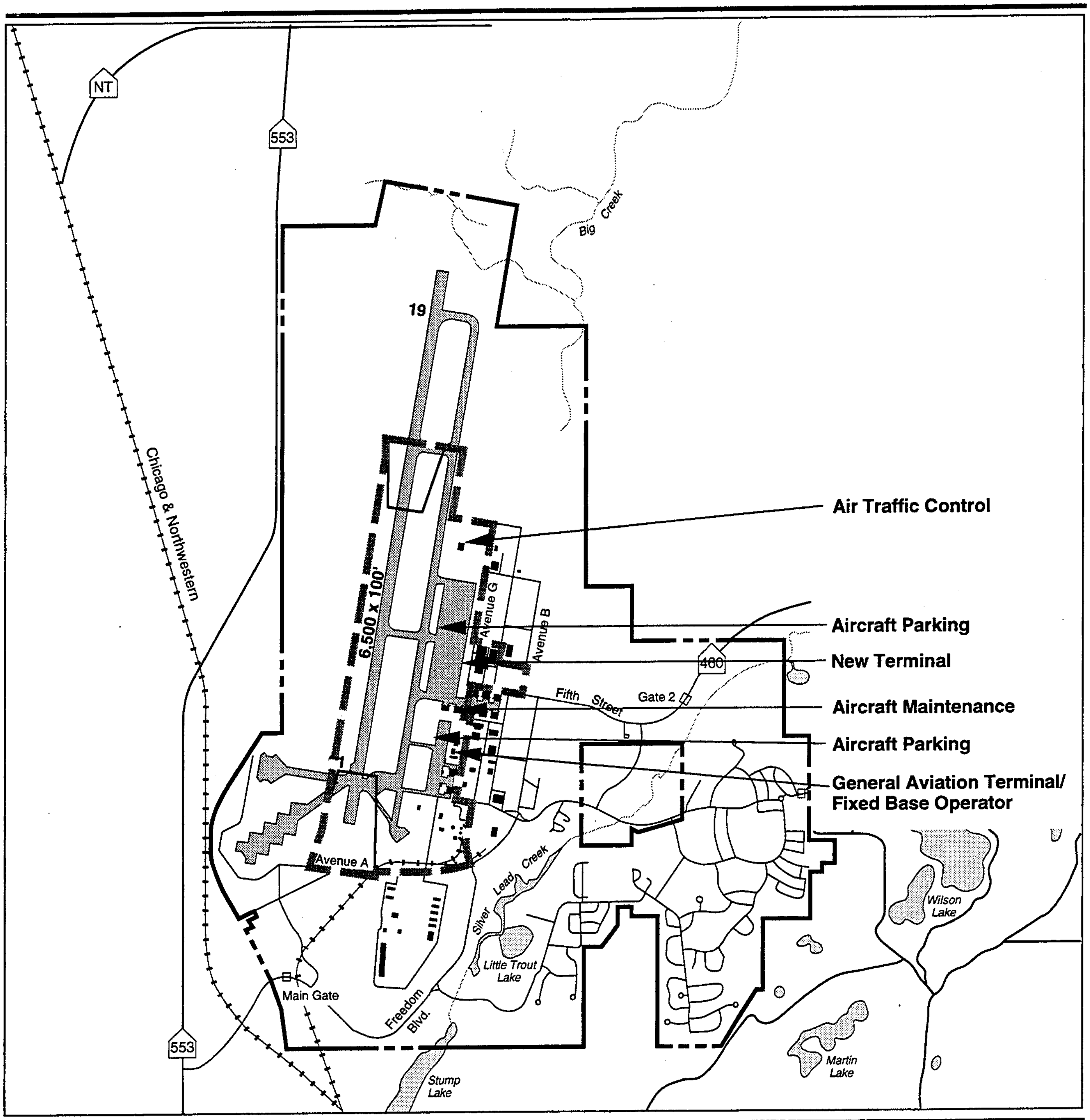
Table 2.3-7. Facility Development - Commercial Aviation Alternative

Land Use	Existing Facility Demolition	Existing Facility Retention	New Facility Construction
	(thousands of square feet of floor space)		
Airfield	0	0	0
Aviation support	139	430	55
Industrial	15	411	164
Institutional			
Educational	84	2,323	0
Commercial	32	137	3
Residential	0	666	0
Public facilities/recreation	1,326	8	0
Agriculture	41	2	0
Total	1,637	3,977	222

Table 2.3-8. Acres Disturbed - Commercial Aviation Alternative

	Acres Disturbed (by phase)			
Land Use	1995-2000	2000-2005	2005-2015	Total
Airfield	0	0	0	0
Aviation support	2	2	5	9
Industrial	21	1	7	29
Institutional				
Educational	4	3	4	11
Commercial	1	0	0	1
Residential	0	0	0	0
Public facilities/recreation	61	0	0	61
Agriculture	148	0	0	148
Total	237	6	16	259

The airport layout characteristics related to commercial and general aviation aircraft operations (e.g., runway/taxiway dimensions, separations, clearances) were developed using the FAA Airport Design Advisory Circular 150/5300-13. The airport area in this layout includes aviation and aviation support land uses that may generate revenue for financial support of the airport. The following major improvements to the airfield would occur:



EXPLANATION

Airport Boundary

Airfield Pavement

Runway Protection Zone

Base Boundary

0 950 1900 3800 Feet

Preliminary Airport Plan - Commercial Aviation Alternative

Figure 2.3-4

- Designation of a 6,500-foot by 100-foot south section of existing runway as a visual flight rule (VFR) runway

- Painting and marking of existing runway pavement to conform to aviation runway marking standards

- Construction of a new passenger terminal on the east side of the north apron

- Installation of Category I Precision ILS and PAPIs on Runway 01/19 and retention of the VOR facility

- Retention or replacement of the RAPCON facility and installation of an automated international weather observation station.

Additional airport improvements would be made to meet FAA requirements. The airfield and aviation support areas would likely be conveyed to an airport authority, which would manage the development and operation of the airfield in accordance with the FAA and state regulations. The existing underground aircraft hydrant fueling system would be abandoned in place or removed.

Projected annual aircraft operations related to the aviation activities at K. I. Sawyer AFB are provided in Table 2.3-9 for 2000, 2005, and 2015. Based on historic weather and wind patterns, up to 70 percent of the projected aircraft operations would use Runway 01, while the remaining 30 percent would use Runway 19.

Projected annual aircraft operations include commercial passenger and general aviation. Projected transient aircraft operations are assumed to be in support of these two major aviation user groups and are included in the operations projections totals. A full-service FBO would be established at the airport to provide general aviation functions and services.

For analysis purposes, 90 percent of the aircraft operations in each of the planning years are projected to occur between 7:00 a.m. and 10:00 p.m.; the remaining 10 percent would occur between 10:00 p.m. and 7:00 a.m.

The flight tracks utilized by K. I. Sawyer AFB aircraft to transition to and from the area airspace will be eliminated upon closure. New flight tracks consisting of a straight arrival/departure path to each end of the main runway would be instituted. Additionally, a closed-end left and right traffic pattern would be created at each end of the runway.

2.3.2.2 Aviation Support. The aviation support area encompasses 325 acres, or 7 percent of the base property, and consists of one parcel east of the runway. This parcel includes the ATC tower, aircraft fuel

Table 2.3-9. K. I. Sawyer AFB Projected Flight Operations - Commercial Aviation Alternative

Year	Operations	Function	Percent	Fleet Mix[a]	Annual Operations[b]
2000	Regional	Air carrier	6	Beech 1900	2,552
			1	Saab 340	232
			20	ATR-42	8,352
			1	ATR-72	464
	General aviation	Private aircraft	56	Single engine	23,700
			12	Multi-engine	5,000
			2	Turboprop	1,000
			2	Turbojet	1,000
				Total	42,300
2005	Regional	Air carrier	5	Beech 1900	2,600
			1	Saab 340	650
			19	ATR-42	9,100
			1	ATR-72	650
	General aviation	Private aircraft	55	Single engine	26,500
			13	Multi-engine	6,300
			3	Turboprop	1,300
			3	Turbojet	1,000
				Total	48,100
2015	Regional	Air carrier	4	Beech 1900	2,325
			2	Saab 340	1,085
			17	ATR-42	10,540
			2	ATR-72	1,550
	General aviation	Private aircraft	56	Single engine	34,000
			14	Multi-engine	8,500
			3	Turboprop	1,700
			2	Turbojet	1,200
				Total	60,900

Notes: (a) Typical projected air carrier aircraft types.
(b) An aircraft operation as one takeoff or one landing.

storage area, flight simulator, eight-bay fire station, some aircraft maintenance hangars, and storage buildings.

Aircraft maintenance facilities would be located in the west end of the existing B-52 aircraft maintenance complex, which contains over 200,000 square feet of floor space and is in the central portion of the aprons east of the main runway. This area includes two of the eight large aircraft maintenance hangars and associated aircraft parts and equipment storage buildings. The base operations building and associated apron east of the runway would be utilized by the aircraft fueling contractor and the airfield maintenance staff. New aviation fuel storage tanks would be installed in the aviation support area.

Included within the aviation support area would be a new 40,000-square-foot commercial passenger terminal, which would be constructed east of and adjacent to the existing northern apron. The aviation support facilities would be approximately 100 percent utilized by 2015.

2.3.2.3 Industrial. The industrial area covers 494 acres, or 10 percent of the base property, in four parcels. The first parcel, west of the runway, contains the alert aprons. The second parcel includes the Weapons Storage Area and storage buildings. Anticipated industrial uses include warehousing, storage, and manufacturing activities. The third and fourth parcels include the WWTP and heating plant. Industrial development would begin in 1995 and would be approximately 55 percent complete by 2015.

2.3.2.4 Institutional. The institutional (educational) land use covering 546 acres, or 11 percent of the base, is divided into five parcels. The first two parcels, in the center portion of the base, contain the VAQ, VOQ, two dormitory complexes, a flight simulator, storage facilities, base hospital, and the education center buildings. These parcels would be developed for an institutional vocational/technical training center for approximately 1,500 students. The types of training activities that could take place include search and rescue, heat and sewage plant operations, golf course management, forestry management, child care, hospital aid, and mining skills. The two dormitory complexes would house up to 760 students. The third parcel, in the southeast portion of the base consists of 653 housing units, which would be utilized by married students and instructors. The fourth parcel, southwest of Gate 3, would use the existing Youth Center, the Child Care Center, and the chapel. The fifth parcel, in the southern portion of the base, includes the small arms firing range. The range would be used for public safety training. No new construction is planned and educational reuse would be complete by 2015.

2.3.2.5 Commercial. The area proposed for commercial reuse covers 25 acres, or less than 1 percent of the base acreage, in the central portion of the base. This area would be reused for neighborhood retail and office space. Commercial development could begin soon after closure and would be 40 percent complete by 2015.

2.3.2.6 Residential. The residential land use encompasses 147 acres, or 3 percent of the base, within two parcels. The first parcel is east of Little Trout Lake and includes 198 housing units that would be reused for permanent residences. The second parcel is south of the golf course and contains 192 units, which would be renovated for seasonal resort housing. Development would be initiated immediately after closure and would be 100 percent complete by 2015.

2.3.2.7 Public Facilities/Recreation. The proposed public facilities/recreation area consists of 1,387 acres, or 28 percent of the base property.

This area is northeast and southwest of the airfield. The reuse for this area would be similar to that described in the Proposed Action. The residential units within this land use would be demolished after closure. The Silver Lead Creek riparian area would be used for recreational purposes.

2.3.2.8 Agriculture. The agricultural land, which is in the northern half of K. I. Sawyer AFB, covers 1,489 acres, or 30 percent of the base. The existing runways and taxiways within this area would be retained. This area would be utilized for timber production, which would commence immediately after closure. It is anticipated that timber harvesting may occur at least once within the 20-year analysis period.

2.3.2.9 Employment and Population. By 2015, the Commercial Aviation Alternative would generate a total of 2,226 direct jobs (Table 2.3-10). A total of 3,680 persons would reside on base property.

Table 2.3-10. Site-Related Employment and Population - Commercial Aviation Alternative

	Closure	2000	2005	2015
Direct employment	50	1,085	1,700	2,226
On-base population[a]	0	920	1,840	3,680

Note: (a) Includes students.

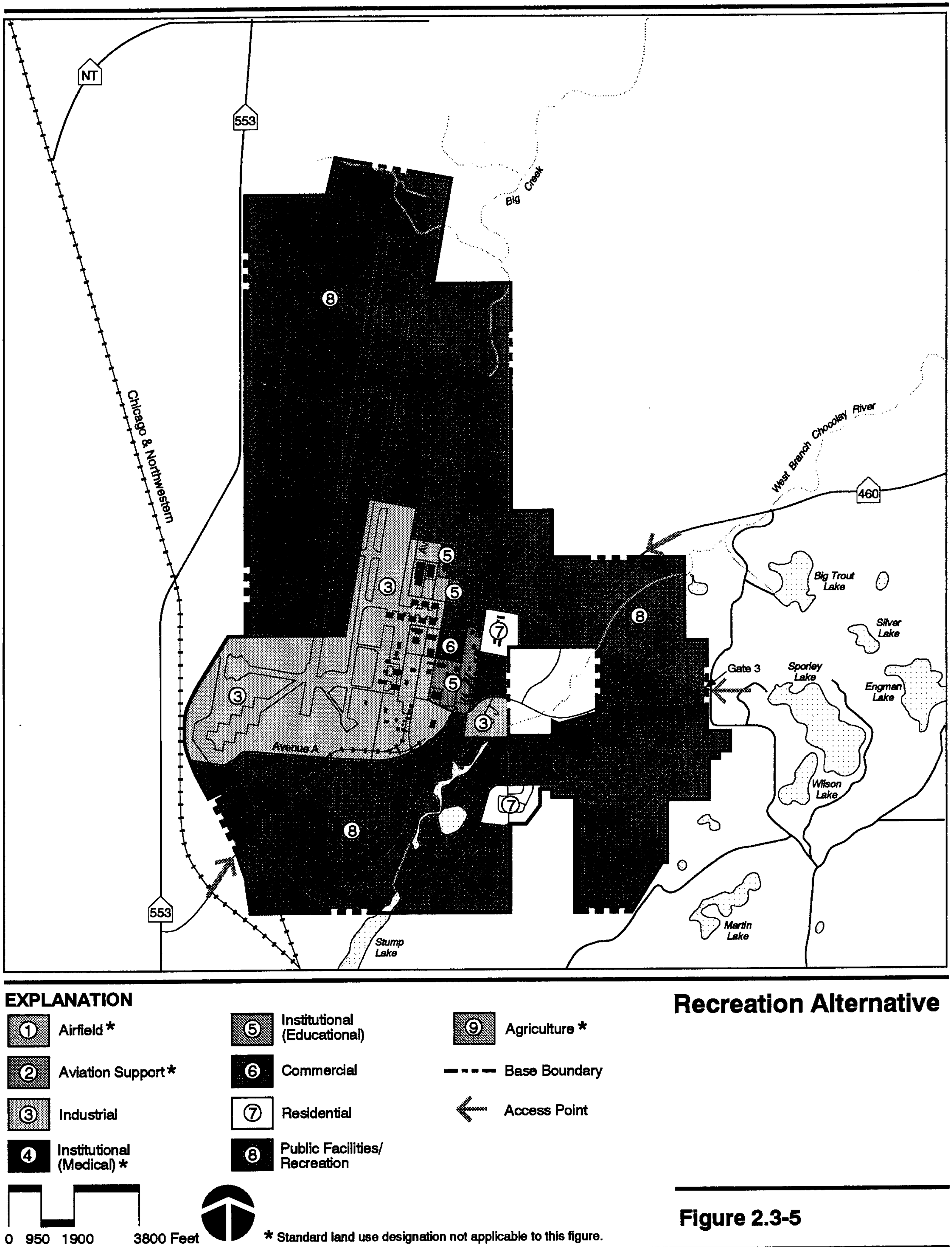
2.3.2.10 Transportation. Existing transportation access points to the base property would be used and no new access would be provided (see Figure 2.3-3). Based on land use and employment projections, this alternative would generate an average of 20,700 vehicle trips daily by 2015. Most vehicular traffic would occur during daylight hours.

2.3.2.11 Utilities. By 2015, the projected activities associated with the Commercial Aviation Alternative would generate the following total utility usage:

- Water - 0.7 MGD
- Wastewater - 0.6 MGD
- Solid waste - 14 tons per day
- Electricity - 94 MWH per day
- Natural gas - 0.9 MMCF per day.

2.3.3 Recreation Alternative

The focus of the Recreation Alternative (Figure 2.3-5) is restoration and conservation of natural resources for a regional multi-use recreation area.



* Standard land use designation not applicable to this figure.

Recreation Alternative

Figure 2.3-5

Over 80 percent of the base would therefore be utilized for public facilities/recreation activities. The remaining portions of base property would be developed for industrial, institutional (educational), commercial, and residential uses. The total acreage for each land use category is shown in Table 2.3-11.

Table 2.3-11. Land Use Acreage - Recreation Alternative

Land Use	Acreage
Industrial	797
Institutional	
Educational	67
Commercial	13
Residential	60
Public facilities/recreation	3,986
Total	4,923

The types of assumptions developed in support of the analysis for the Recreation Alternative were similar to those used for the Commercial Aviation Alternative, except for deletion of the aviation component. The existing (retained) facilities may not be fully utilized during the 20-year study period.

The amount of development through 2015, including existing facility demolition, facility retention, and new facility construction for each land use under the Recreation Alternative, is provided in Table 2.3-12.

Table 2.3-12. Facility Development - Recreation Alternative

	Existing Facility Demolition	Existing Facility Retention	New Facility Construction
Land Use	(thousands of square feet of floor space)		
Industrial	200	984	46
Institutional			
Educational	64	411	0
Commercial	47	46	0
Residential	0	346	0
Public facilities/recreation	3,094	225	0
Total	3,405	2,012	46

Table 2.3-13 summarizes acreages assumed to be disturbed by construction or other operational activities during each phase of development. The sections below describe activities associated with each land use category.

Table 2.3-13. Acres Disturbed - Recreation Alternative

	Acres Disturbed (by phase)			
Land Use	1995-2000	2000-2005	2005-2015	Total
Industrial	2	2	3	7
Institutional				
Educational	1	1	1	3
Commercial	1	0	0	1
Residential	0	0	0	0
Public facilities/recreation	95	95	0	190
Total	99	98	4	201

This alternative incorporates the general concept of the Air Force lease agreement with the state of Michigan. Upon termination of the lease, the Air Force could be required to return state-leased land at K. I. Sawyer AFB (approximately 41 percent of the base) to its natural condition, if requested by the designated state authority and if the facilities and infrastructure are not utilized or needed in the future by the state. Under this alternative, approximately 80 percent of the base would be restored to its natural condition, and up to 65 percent of the facilities would be demolished. Although some state land may not be designated for restoration under this alternative, a larger area than that owned by the state would be restored.

2.3.3.1 Industrial. The proposed industrial land use area covers 797 acres, or about 16 percent of the base property, in two parcels. The first parcel is along the eastern and southern portions of the airfield and includes the alert apron, fire stations, maintenance, and storage facilities. Industrial uses would include light industrial, manufacturing, storage, and warehousing. Under this reuse, the heating plant would be converted to an electric generating facility. The second parcel, adjacent to Silver Lead Creek, contains the WWTP. The WWTP and heating plant would be reused within the first 5 years after closure. The other industrial use areas would be 5 percent utilized by 2015.

2.3.3.2 Institutional. The institutional (educational) land use area covers 67 acres, or 1 percent of the base property, in two parcels. The first parcel, west of Avenue B, contains a communications building and a security building. The facilities, which could accommodate approximately 250 students, would be used for research and training for the timber or mining

industry. A parcel south of the first parcel includes a dormitory complex, the chapel, and the recreation center. The reuses for these facilities would remain the same in support of the training activities. Institutional reuse would be approximately 80 percent complete by 2015.

2.3.3.3 Commercial. The commercial area includes 13 acres, or less than 1 percent of the area, in the central portion of the base. This area includes the Commissary, Base Exchange, and other retail facilities, which would be developed for neighborhood retail and office uses. Commercial uses could include back offices, such as telecommunications or order processing divisions of financial companies, and casino gaming. Development would be approximately 75 percent complete by 2015.

2.3.3.4 Residential. The residential reuse area encompasses 60 acres, or 1 percent of the area, and includes two parcels. The first parcel is southwest of the golf course and consists of a dormitory complex that could house up to approximately 375 people and would be reused for visitor lodging. The second parcel, east of Little Trout Lake, contains 112 units that would be used for seasonal housing. The residential units would be 100 percent occupied by 2015.

2.3.3.5 Public Facilities/Recreation. The public facilities/recreation area contains most of the undeveloped regions of the base, and includes most of the airfield. The existing runways and taxiways within this area would be retained. This area, covering 3,986 acres or about 81 percent of the base property, would be used for regional recreational activities, with emphasis on winter sports such as cross-country skiing and snowmobiling. The Silver Lead Creek riparian area would be set aside for natural resource conservation. The golf course would be retained and utilized for cross-country skiing in the winter. The hospital would be reused as an interpretive center, cultural center, or museum, and could include space for small conferences or retreats. The two mobile home parks would be converted to publicly administered seasonal recreation vehicle use. The housing units within the public facilities/recreation area would be demolished, with reuse of all other facilities within this land use occurring within 10 years after closure.

2.3.3.6 Employment and Population. By 2015, the Recreation Alternative would include a total site-related employment of 856 direct jobs (Table 2.3-14). A total of 938 persons would reside on base, of which 25 percent would be year-round residents and the remainder seasonal residents or visitors.

2.3.3.7 Transportation. The existing transportation access points to the base property would be used and no new access would be provided. Based on land use and employment projections, this alternative would generate an

Table 2.3-14. Site-Related Employment and Population - Recreation Alternative

	Closure	2000	2005	2015
Direct employment	50	405	631	856
On-base population[a]	0	232	465	938

Note: (a) Includes students.

average of 6,200 daily vehicle trips by 2015. Most vehicular traffic would occur during the daylight hours.

2.3.3.8 Utilities. By 2015, the projected activities associated with the Recreation Alternative would generate the following utility usage:

- Water - 0.2 MGD
- Wastewater - 0.1 MGD
- Solid waste - 4 tons per day
- Electricity - 21 MWH per day
- Natural gas - 1.0 MMCF per day.

2.3.4 No-Action Alternative

The No-Action Alternative would result in the federal government retaining ownership of the Air Force fee-owned property after closure. Non-fee-owned property would return to the lessee upon mutually agreed termination of the lease. The base property would not be put to further use, but would be preserved (i.e., placed in a condition intended to limit deterioration and ensure public safety). All base property would be placed in caretaker status. The Air Force would be responsible for caretaker activities on Air Force fee-owned land; it is assumed that the property owners would also maintain their property in caretaker status. Caretaker activities would consist of base resource protection, grounds maintenance, operation of existing utilities as necessary, and building care. No other military activities/missions are anticipated to be performed on the property.

The future land uses and levels of maintenance on base property would be as follows:

- Maintain structures to limit deterioration.

- Isolate or deactivate utility distribution lines on base.

- Provide limited maintenance of roads to ensure access.

- Provide limited grounds maintenance of open areas to eliminate fire, health, and safety hazards.

2.3.5 Other Land Use Concepts

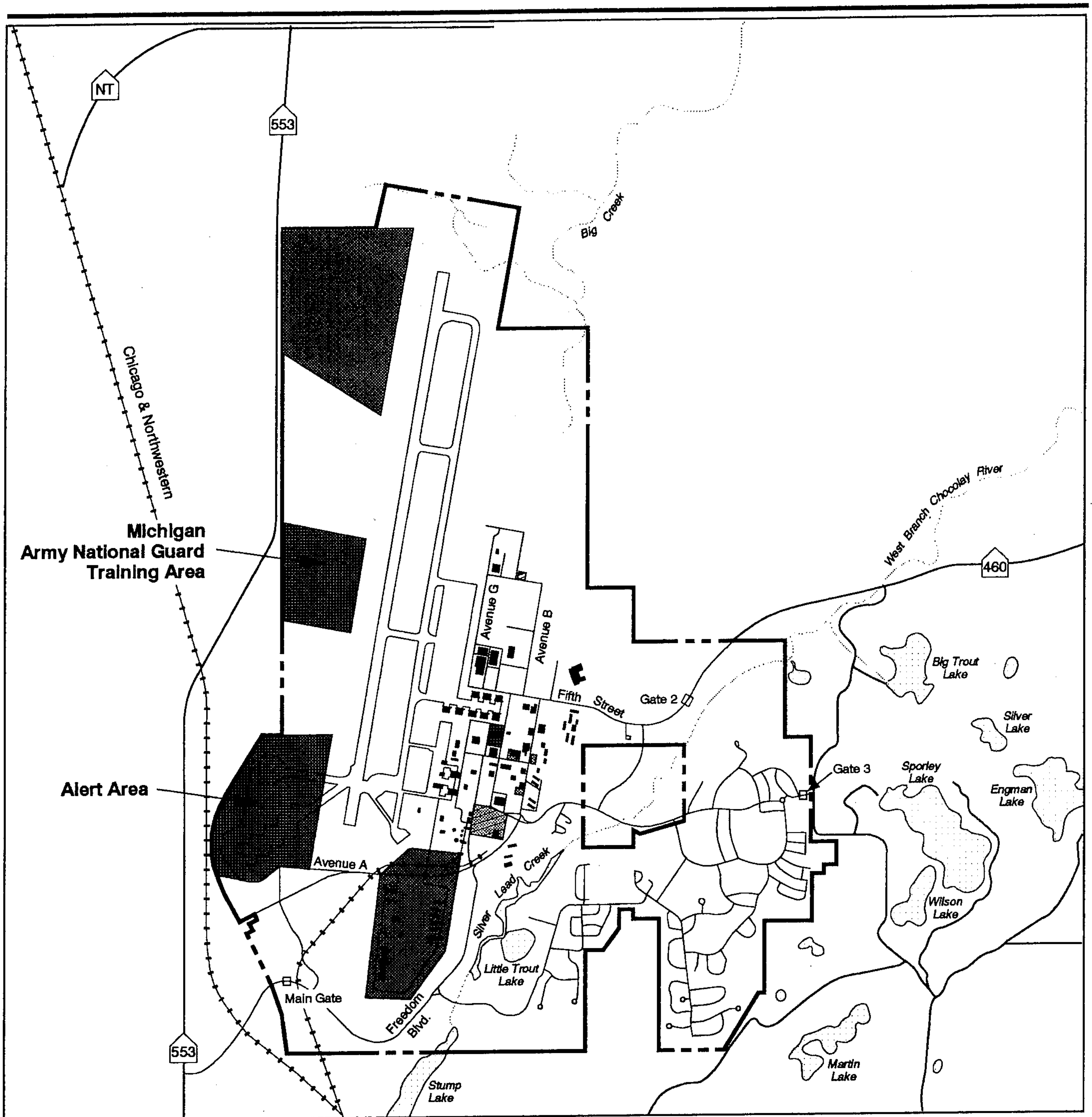
In compliance with the Federal Property and Administrative Services Act of 1949, the Air Force has solicited proposals from other federal agencies regarding their interest in acquiring any lands or facilities identified for disposal at K. I. Sawyer AFB. To date, a formal proposal for federal conveyance for K. I. Sawyer AFB has been identified for the MANG along with three proposals from private parties (Figure 2.3-6). In addition to these proposals, public interest was expressed for a correctional facility (prison) at K. I. Sawyer AFB.

This section describes land use concepts that are not part of any integrated reuse plan, but could be initiated on an individual basis. These concepts could include proposed federal transfers and conveyances to non-federal agencies and private parties. They are independent of one another and could be implemented individually or in combination with any of the reuse plans. The MANG land use concept has been included within the K. I. Sawyer Base Conversion Authority reuse plan. However, the land approved by the community for use by the MANG is slightly different from that requested by this organization. The section below describes the land requested by the MANG and private parties.

2.3.5.1 Michigan Army National Guard. The MANG has expressed an interest in utilizing portions of the base property as a headquarters for the 107th Combat Engineering Battalion of the Upper Peninsula, which currently includes 900 Guard members. Activities would involve an average of 30 weekend drills per year, each consisting of approximately 150 people. The MANG would utilize the vehicle maintenance shop (Building 608), which has 20 bays and a paint booth, for vehicle and equipment maintenance; the readiness crew facility (Building 104) for dormitory and dining facilities; the rifle range; and an area west of the main runway for driving skills practice with bulldozers, dump trucks, and other industrial equipment. It is anticipated that these vehicles would not be used to move earth, and that the only ground disturbance would be from their movement during training. The MANG activities would utilize existing base utility systems and demands would be negligible. The MANG anticipates relocating to the base within the first 5 years after closure.

2.3.5.2 Correctional Institution. The correctional institution concept would include approximately 273 acres, or nearly 6 percent of the total base area, for development of a maximum security correctional facility. Construction of the correctional facility is proposed to begin 5 years after closure and would be complete by 2015.

The correctional institution would occupy the northwest portion of the base in the undeveloped area west of the runway. The correctional facility would include living quarters, and administrative, maintenance, and warehousing



EXPLANATION

- Base Boundary
- Sawmill
- Michigan Army National Guard
- Correctional Institution
- Waste to Energy/Recycling
- Waste to Energy/Environmental Support Operations

0 950 1900 3800 Feet

Other Land Use Concepts

Figure 2.3-6

facilities. Total facility construction would be approximately 500,000 square feet and consist of one- and two-story buildings sited within a fenced compound, surrounded by a buffer zone. The prison would house 1,600 inmates and provide jobs for approximately 250 full-time employees.

Access to the correctional institution would be provided via CR 553 west of the site. Based on land use and employment projections, average daily traffic to and from the site would be approximately 670 by 2005 when the prison would be fully operational.

The area within this land use concept assumed to be disturbed by construction of facilities, infrastructure improvements, or other operational activities is 161 acres during the period from 2000 to 2005. By 2015, the projected activities associated with the correctional institution would generate the following on-base utility demands:

- Water - 0.35 MGD
- Wastewater - 0.3 MGD
- Solid waste - 3.2 tons per day
- Electricity - 12 MWH per day
- Natural gas - 0.12 MMCF per day.

Existing utility distribution systems would need to be extended to provide adequate service to the proposed new facilities. The correctional institution would use the existing utility systems on base (i.e., WWTP and water supply).

2.3.5.3 Sawmill. The sawmill concept would include approximately 142 acres, or 3 percent of the base area, for use as a sawmill including a dry kiln and planing mill. Construction of the sawmill and its operation would occur within the first 5 years following closure.

The sawmill would occupy an area in the southern portion of the base and would include the Weapons Storage Area and Building 441 north of Avenue A. The facility would require construction of a sawmill, boiler, planing mill, and dry kiln. Total facility construction would be approximately 25,000 square feet, requiring 2 acres to be disturbed during the period from 1995 to 2000. In addition, Building 331 within the Weapons Storage Area would be modified to allow for conveyor entry into the building. The sawmill would also require aboveground storage tanks to provide fuel for mobile equipment with a total storage capacity of 10,000 gallons.

When fully operational, the sawmill would employ approximately 90 persons at the base and would process between 45 and 75 million board feet of timber annually. The proposed sawmill is a high-tech mill that uses 15 percent less roundwood than conventional models to produce the same output. Timber for the mill would be obtained from the northern Lower

Peninsula of Michigan, the Upper Peninsula, and northeast Wisconsin, and would consist of spruce, balsam, pine, hemlock, and tamarack.

Access to the site would be provided through the Main Gate and Gate 2, with average daily traffic to the site anticipated at 380 vehicles when the sawmill is fully operational. In addition, the existing rail spur on base would be utilized for incoming timber and outgoing lumber. By 2000, the projected activities associated with this concept would generate the following on-base utility demands using the existing base utility system:

- Water - 0.1 MGD
- Wastewater - 0.1 MGD
- Solid waste - 2 tons per day
- Electricity - 3 MWH per day
- Natural gas - 0.04 MMCF per day.

Indirect Activities Associated with Sawmill Implementation. For purposes of this EIS, it is estimated that 75 million board feet of timber could be potentially processed at the proposed mill. It is further assumed that this requirement would be procured from new sources within the timber procurement area for the sawmill. However, it is likely that some of the demand for the sawmill may be offset by a decrease in timber demand from other sources.

The types of activities associated with management of forest resources to provide forest products are described in this section. These include the silvicultural systems employed, new road construction, logging methods, site preparation activities, reforestation, and stand maintenance activities. The systems discussed below are those that are likely to be used for timber harvesting activities associated with the proposed sawmill.

Silvicultural systems. Silviculture is defined as the use of ecological, economic, and social knowledge to manipulate a forest ecosystem to achieve specific sustainable benefits (Jaakko Poyry Consulting, Inc., 1992e). Silvicultural systems are most commonly classified according to the reproductive method employed on a given stand, since this method has a decisive influence on the form and treatment of the stand (Jaakko Poyry Consulting, Inc., 1992e). The reproductive method refers to the method of carrying out the tree cutting (felling) which removes a mature timber crop. This method is guided by the type of regeneration (i.e., seeding or planting) to be accomplished, which will ultimately determine the type of forest to be produced. The two major management methods used include even-aged and uneven-aged management.

Even-aged management systems have been subdivided into clearfelling, shelterwood, and seed tree methods. Thinning may be used as an intermediate step to achieve management goals under any of these

even-aged systems. The ultimate goal of these methods is the creation of timber stands of essentially the same age (although not necessarily of a single species). Clearfelling is defined as the removal of all trees from an area in a single cut to produce an even-aged stand. For purposes of discussion, clearfelling includes the following classifications, based on the size and shape of the cut:

- Clearcutting - a clearfelled area greater than 5 acres
- Block cutting - a clearfelled area less than 5 acres and regular (usually square) in shape
- Patch cutting - a clearfelled area less than 5 acres and irregular in shape. These cuts are generally more aesthetically pleasing than block cuts
- Strip cutting - a clearfelled area generally the width of the effective seeding distance of standing trees for a species. Strip cuts are generally 300 feet wide by 1,200 feet long.

Shelterwood cutting is used to supply seed or provide an environment conducive to sprouting, along with shelter for a regenerating stand. This system requires at least two cuts prior to final harvest: the initial cuts are used to stimulate reproduction through increasing seed production, and/or encourage sprouting, while at the same time supplying increased light to new seedlings or sprouts. The remaining larger trees provide shelter from the effects of excessive fluctuations in moisture, temperature, and, in some cases, insect pests to the regenerating stand (Jaakko Poyry Consultants, Inc., 1992e). Once the stand is successfully regenerated, the sheltering trees are removed.

Seed tree cutting is similar to shelterwood cutting, except that fewer residual trees are left on the stand. Seed trees can be evenly distributed over a cutover stand, or left in groups. The purpose of utilizing seed trees is to regenerate (reseed) the stand using these residuals. Once sufficient seedling stocking is achieved, the seed trees are removed.

As discussed above, thinning is not a silvicultural system; it is an intermediate cutting to increase diameter growth on residual trees, salvage trees that have died or are declining, reduce the rotation age, alter the species composition, or to increase stand vigor (i.e., remove trees to reduce pathogens or increase wind-firmness in the residual stand). Thinning may be from below (i.e., leaving the larger trees) or above (removal of larger trees to release the most promising smaller trees from competition).

Assuming the entire sawmill timber harvest would come from new sources within the harvest procurement area, it is estimated that 7,000 acres per year, or 100 percent of the total procurement area would be harvested using

even-aged management systems. Of this total, approximately 4,300 acres would be clearcut annually, while 2,700 acres would be subjected to thinning activities. It should be noted, however, that other even-aged and uneven-aged management systems may be utilized in the procurement used depending on site-specific conditions.

Uneven-aged management systems involve the application of a combination of actions to simultaneously maintain a dominant forest cover, enable recurring regeneration of desirable species, and provide for orderly growth and development of trees through a wide range of diameters and age classes. This silvicultural system is most applicable to shade tolerant species (i.e., those which grow under the shade of other trees). For purposes of analysis, it is assumed that no uneven-aged management would occur as an indirect result of sawmill implementation.

Road Construction. In order to provide access to potential harvest areas in the timber procurement area, it has been assumed that new road construction would be required in both Michigan and Wisconsin. As mentioned previously, specific harvest areas within the procurement area are not known, and therefore specific locations of new road construction cannot be determined. In order to estimate road construction, several assumptions were made, based on planning reports conducted within the Lake States region (George Banzhaf & Company, 1995a; Jaakko Poyry Consulting, Inc., 1992c). One of the main factors used to determine new road construction requirements was distance from maintained road (i.e., plowed or graded at least once each year). Another factor to consider is that once a road is constructed, that road can be used in subsequent years to access adjacent sites, reducing future road construction requirements. Therefore, the amount of road construction would likely be higher in the first year of proposed activity than in subsequent years. Based on an annual harvest area of 7,000 acres, it is estimated that 44 miles of dirt road would be constructed (or upgrades of nonmaintained roadways) each year of the 15-year analysis period. Based on an estimate of 70 acres per harvest area, less than 0.5 miles of road would be constructed at each site.

Logging Methods. In general, standing timber is removed from the stump by either a chain saw, feller buncher, or harvester. Once removed from the stump (or felled) the usable portions of the tree (which can include up to the entire stem, limbs, and foliage) are separated from those portions not to be utilized. These processes are called delimbing and topping. Bucking occurs when usable wood fiber is separated for transport (i.e., long logs are bucked for transportation to the mill). Delimbing, topping, and bucking can occur either at the stump or at roadside, depending on the felling system used. Once prepared for transport, the tree is carried either on or above the ground to a landing via skidder or other heavy equipment where it is loaded onto logging trucks for transportation to a mill.

The major activities associated with logging include felling, delimbing and topping, bucking, off-road transport, and hauling of usable forest products. Ground disturbance associated with logging activities is dependent on the individual site characteristics, i.e., slope, soil moisture, temperature (frozen ground conditions), and residual ground cover; as well as the type of felling and transport equipment used, and the location of delimbing, topping, and bucking activities.

For purposes of analysis within this EIS, the following assumptions have been made:

- All new areas would be harvested using a mechanical harvester and two skidders.

- Seventy-five percent of the wood would be hauled in Michigan, where trucking weights are substantially higher than in Wisconsin.

- A total of 230 operating days would occur in a given year (allowing for a 5 day per week operation with a 6-week down period during spring).

Based on these assumptions, the number of annual logging truck trips (round trips) is estimated at approximately 4,500 (or 20 round trips per day), with an average of approximately 585,000 truck-miles driven annually (2,543 truck-miles per day). Harvesters are expected to operate a total of 10,800 hours per year, while skidders would operate a total of 21,600 hours per year.

Site Preparation. In order to be successful, many silvicultural systems require the application of associated management techniques to prepare a site as a seed bed; to reduce the density of competing plants; to fend off diseases, insect, and animal predation; and to optimize growth and yield of the stand. Competition for light, space, nutrients, and water can severely affect the success of an individual timber plantation early in its development. The main emphasis of site preparation is to prepare a seed or seedling bed which is free from agents that would compete with planting and young tree growth. Additional benefits include reduction of vegetation and forest debris that could eventually fuel destructive wildfires, development of browse and cover for wildlife, improvement of recreation potential on a site, and other non-timber production goals. The types of activities associated with site preparation are discussed below.

Several methods of site preparation are employed in the Great Lake States. The primary tools used to prepare a site prior to seeding or planting include mechanical methods, prescribed burning, and chemical (herbicide) application. These tools may be used independently or in conjunction with one another to optimize site conditions.

- Mechanical site preparation methods involve the use of hand and power tools and/or heavy equipment, depending on site characteristics. Mechanical site preparation activities occurring near surface waters are regulated in both Wisconsin and Michigan.

- Prescribed burning involves the planned use of fire to remove competing vegetation and forest floor debris. The use of prescribed burning on state and private lands in Michigan and Wisconsin requires procurement of a burning permit prior to onset of activities.

- Chemical treatment includes the use of pesticides to control competing vegetation, insects, and disease, and to enhance tree growth. Chemicals can be applied either from the ground or aerially. Applicators of chemicals are required to follow U.S. EPA regulations which include qualifications for applicators and specific instructions carried on pesticide container labels, including those restricting use of pesticides near surface water sources, and proper transportation and disposal methods.

For purposes of analysis within this EIS, it is assumed that one or more of the site preparation methods identified above would be used in new timber procurement activities.

Reforestation. Reforestation is the establishment of a new tree crop, either through natural or artificial means, and generally occurs after harvest and site preparation activities have taken place. For purposes of this analysis, reforestation would occur on all areas that are subject to clearcutting, totaling 4,300 acres. Areas subjected to thinning would generally not require reforestation. It is unknown what percent of reforestation would come from natural (i.e., seeding from adjacent forests) or artificial means (i.e., planting seeds or seedlings on the site).

Stand maintenance. Stand maintenance activities can be similar to those utilized for site preparation; however, these activities generally occur between the time the stand is reforested and prior to the final cut of the area. Therefore, while the methods used can include the mechanical, prescribed burning, or chemical treatment activities described under site preparation, an additional constraint is to preserve the timber stand that has emerged since reforestation occurred. Additional stand maintenance activities may include precommercial thinnings (i.e., removal of small trees to reduce stand density prior to their growing to a commercially valuable size).

2.3.5.4 Waste to Energy/Recycling. This concept would include the use of warehouse facilities (Buildings 417 and 419), the Solid Waste Center (Building 735), and the base heating plant for use as a recycling center and waste to energy facility utilizing municipal solid waste as a fuel source.

Construction of the initial pilot system would begin within the first 5 years following closure.

Initially, approximately 35 tons per day of municipal solid waste would be shipped from the Marquette area to Building 735 where the waste would be cleaned and sorted. Recyclable material such as glass, plastics, aluminum, ferrous metals, precious metals, and rags would be removed from the municipal solid waste and would be recycled at this facility. In addition to recycling, any hazardous materials (e.g., batteries, paints) would be removed and disposed of in accordance with applicable regulations. After recyclable materials are removed, the remaining organic and cellulosic material would be compressed into briquettes to be burned in a processing plant for energy self-sufficiency or to be sold. The briquettes may be stored for use as fuel or for later conversion into compost. Other materials that would be burned in the processing facility include construction debris, yard waste, sludge, medical and some industrial waste, and tires. The actual materials that can be incinerated would be based on the air quality permit issued by the state of Michigan. This concept should reduce the amount of municipal solid waste going to landfills by 85 percent. With the exception of assembly of the processing unit, no new construction or building modification is anticipated. This concept would also require the use of two aboveground tanks for the storage of water.

This concept would employ approximately 50 persons at the base and would operate 24 hours a day. In addition, approximately 20 to 30 visitors per week are anticipated for tours of the operation or for training. Access to the site would be provided through the Main Gate and Gate 2, with average daily traffic to the site anticipated at 300 vehicles when the plant is fully operational. In addition, the existing rail spur on base could be utilized for incoming waste. By 2000, the projected activities associated with this concept would have a water demand of 0.004 MGD, a wastewater generation of 0.001 MGD, and a natural gas demand of 0.04 MMCF per day. Because this concept is waste to energy, solid waste would be reduced at local landfills, and the operation would generate 1 megawatt of electricity.

2.3.5.5 Waste to Energy/Environmental Support Operations. This proposed land use concept would involve reuse of the Education Center (Building 540), Heating Plant, Hobby Shop (Building 824), Base Exchange (Building 643), and Service Station (Building 826). Construction and operation of this concept would begin within the first 5 years following closure.

Under this concept, a waste to energy incineration system would be put into operation at the base heating plant after the base closes. This system would be fueled by solid municipal waste, used tires, and other materials including sawdust, wood chips, construction waste, and some industrial waste. The actual materials that can be incinerated would be based on the

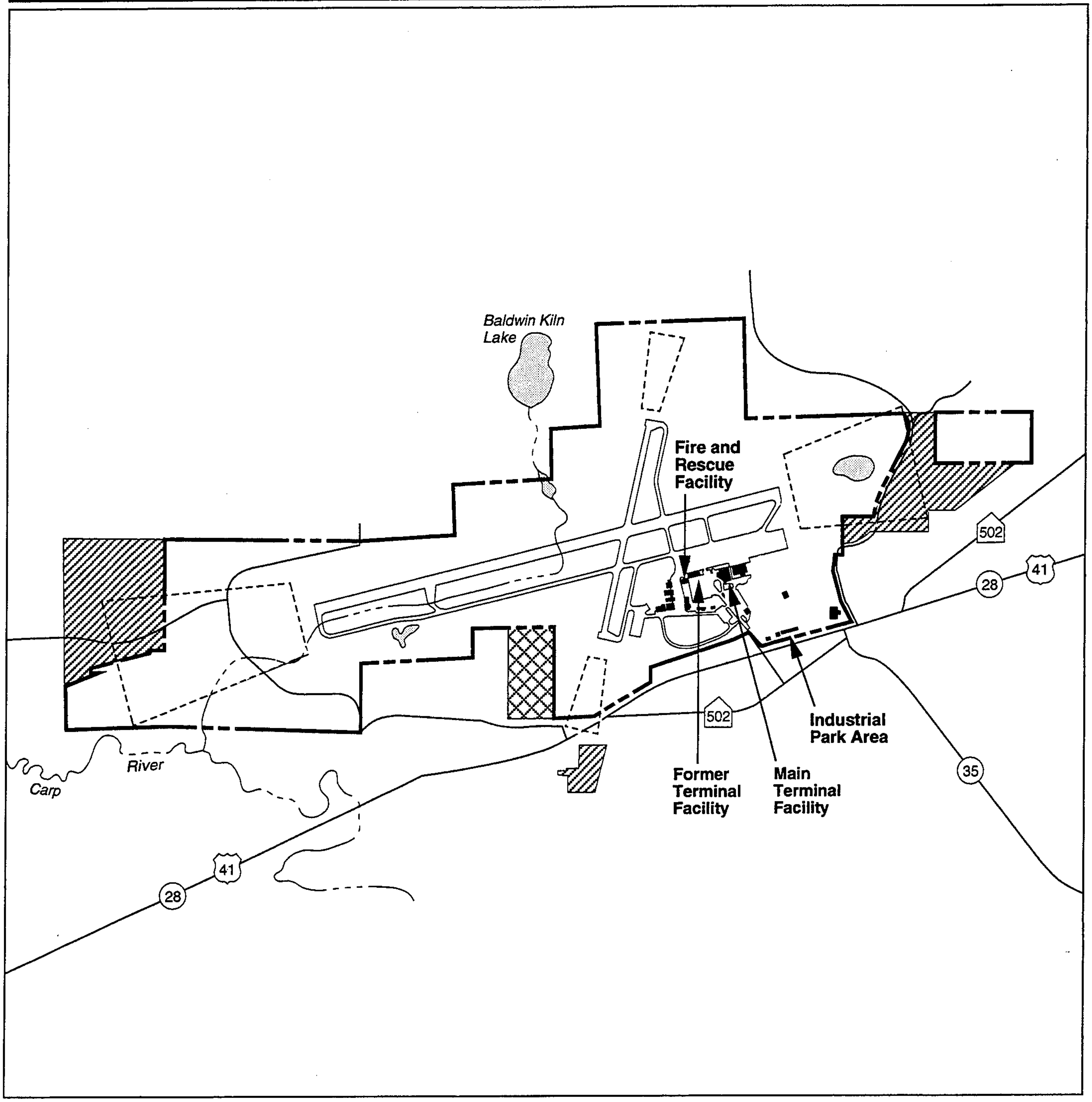
air quality permit issued by the state of Michigan. Up to a total of 1,200 tons per day of waste material could be processed by the plant. Waste materials would be primarily delivered by truck; the on-base rail spur could also be used. Electricity generated by the facility would be sold to a utility company and heat would be provided to on-base facilities. Ash from the incineration process would be taken to an enclosed facility for recovery of ferrous materials; the remainder would be taken to a landfill for disposal or utilized as aggregate in road base and other construction materials. Some new construction within the heating plant area would be required for chipping and waste storage areas. This concept may also require the use of tanks to store fuel for equipment.

Other operations associated with this land use concept would be handling and temporary storage of hazardous materials and wastes collected from cleanup or spill response activities, tank removal/installation, and construction services. Additionally, approximately 5,000 to 10,000 gallons per day of sanitary waste from septic systems would be brought to the base WWTP for processing.

When fully operational, this concept would employ approximately 100 persons and the waste to energy incineration system would operate 24 hours per day. Deliveries of waste materials, hazardous materials, and sanitary waste would take place during regular working hours. Access to the site would be provided through the Main Gate, with average daily traffic to the site anticipated at 500 vehicles when the plant is fully operational. By 2000, the projected activities associated with this concept would have a water demand of 0.5 MGD, wastewater generation of 0.002 MGD, and a natural gas demand of 0.04 MMCF per day. Because this concept is waste to energy, the amount of solid waste sent to local landfills would be reduced and the operation would generate 39 megawatts of electricity.

2.3.6 Closure and Reuse of the Marquette County Airport

The Proposed Action, International Wayport Alternative, and Commercial Aviation Alternative call for the closure of Marquette County Airport and the relocation of its activities to K. I. Sawyer AFB. Retention of commercial aviation activities at K. I. Sawyer AFB under the above reuse alternatives would preclude the need for another commercial airport facility in the county of Marquette; therefore, it was assumed that Marquette County Airport would close under these reuse options. For the EIS analysis it was also assumed that Marquette County Airport operations would phase over to K. I. Sawyer AFB during the first 5 years following base closure in September 1995. Closure of Marquette County Airport would make a total of 670 acres of airport-owned property available for redevelopment (Figure 2.3-7). In addition to the airport-owned property, another 90 acres are covered by avigation easements and 70 acres are leased. The airport facilities consist of the main terminal building; fire and rescue facility; an old terminal facility;



EXPLANATION

Marquette County Airport Property Line

Approach Clear Zone

Avigation Easement

Leased Property

41 U.S. Highway

35 State Highway

502 County Road

0 500 1000 2000 Feet

Marquette County Airport

Figure 2.3-7

and 12 hangar, maintenance, and storage facilities. These existing facilities total approximately 110,000 square feet. In addition, the airport property includes an industrial park along U.S. Highway (U.S. #) 41 that is mostly undeveloped.

No definite plans for the potential reuse of Marquette County Airport have been developed. Based on conversations with local officials and airport representatives, the Air Force has made the following assumptions regarding reuse of the airport:

- Most of the existing facilities are expected to be reused except for some of the older hangar and maintenance facilities, which have little insulation. Total facility demolition is expected to be approximately 20,000 square feet.

- The reuse of existing aprons, runways, taxiways, roads, and parking lots is expected to be maximized to reduce overall redevelopment cost and rubble disposal problems.

- No firm suggestions or recommendations have been made for each reuse. The development of the airport could include a combination of residential, public facilities/recreation, institutional (education and government), commercial, and industrial uses. The industrial and commercial areas are expected to be located in the existing industrial park area and throughout the hangar and maintenance areas. The main terminal could be used for commercial (e.g., office) or institutional (e.g., education, government purposes). The remainder of the open areas around the main and crosswind runways could be developed for residential uses, with the land around the wetlands on the site being converted to public facilities/recreation uses. It was assumed that employment for the site is expected to be less than the peak of approximately 400 airport employees in 1991.

- Good land use planning would minimize impacts on traffic, noise, and air quality.

By 2015, the projected activities associated with potential reuse of Marquette County Airport could generate the following on-site demands:

- Water - 0.07 MGD
- Wastewater - 0.06 MGD
- Solid waste - 3.2 tons per day
- Electricity - 14 MWH per day
- Natural gas - 0.47 MMCF per day.

2.4 ALTERNATIVES ELIMINATED FROM FURTHER CONSIDERATION

To date, no other reuse proposals have been submitted to the Air Force for K. I. Sawyer AFB, nor has the Air Force identified other potential reuse alternatives.

2.5 INTERIM USES

Interim uses include predisposal short-term uses of the base facilities and property. Predisposal interim uses are conducted under lease agreements with the Air Force. The terms and conditions of the leases would be arranged to ensure that the predisposal interim uses do not prejudice future disposal and reuse plans of the base. The continuation of interim uses beyond disposal would be arranged through agreements with the new property owner(s). If an interim use becomes viable for K. I. Sawyer AFB, a use substantially similar to those analyzed in the FEIS after public review would be authorized without further environmental analysis. In some cases, separate environmental analysis to cover the action may be required.

A zero baseline representing conditions at the point of closure is used for the environmental analysis. Predisposal interim uses are not considered in the baseline conditions used for the environmental analysis because the baseline captures the future conditions at the point of closure and does not presuppose a decision of continued interim uses at that time.

2.6 OTHER FUTURE ACTIONS IN THE REGION

The closure and potential reuse of Marquette County Airport as a non-aviation facility was an action identified as possibly contributing to a potential cumulative impact on the disposal and reuse of K. I. Sawyer AFB.

2.7 COMPARISON OF ENVIRONMENTAL IMPACTS

A summary comparison of the reuse-related factors and environmental impacts, along with their potential mitigation, for each biophysical resource affected by the Proposed Action and alternatives over the 20-year study period is presented in Tables 2.7-1 and 2.7-2, respectively. Impacts for air quality are summarized over a 10-year period due to the speculative nature of predicting pollutant emissions and concentrations far into the future under changing regulatory and climatic conditions (see Section 4.4.3). Reuse-related factors are nonbiophysical elements, such as population, employment, land use, aesthetics, public utility systems, and transportation networks, that directly impact the environment. These activities have been analyzed to determine their effects on the environment. Impacts to the environment are described briefly in the Summary and discussed in detail in Chapter 4. Table 2.7-3 presents reuse-related factors and environmental impacts of other transfers and independent land use concepts.

Table 2.7-1. Summary of Reuse-Related Influencing Factors

	Proposed Action			International Waypoint Alternative			Commercial Aviation Alternative			Recreation Alternative			No-Action Alternative[a]
Factor	2000	2005	2015	2000	2005	2015	2000	2005	2015	2000	2005	2015	
Ground disturbance (acres by phase)	171	170	340	159	47	174	237	6	16	99	98	4	0
Aircraft operations (annual)	46,188	52,138	65,088	45,000	72,500	100,000	42,300	48,100	60,900	0	0	0	0
Direct employment	2,668	5,064	9,853	1,489	2,336	3,844	1,035	1,650	2,176	355	581	806	50
Secondary employment	1,986	3,807	7,450	959	1,531	2,528	703	1,093	1,366	154	248	370	13
Population increase	2,528	5,014	10,483	1,411	2,309	4,056	995	1,645	2,301	351	592	863	0
Traffic (total daily trips)	8,750	17,100	33,800	14,200	20,100	30,250	7,150	12,750	20,550	2,450	4,300	6,050	150
Increase in water demand (MGD)	0.96	1.88	3.79	0.72	1.00	1.48	0.35	0.64	1.04	0.10	0.17	0.27	0
Increase in wastewater production (MGD)	0.47	0.92	1.88	0.60	0.84	1.24	0.28	0.51	0.86	0.07	0.13	0.21	0
Increase in solid waste (tons/day)	11.56	22.04	44.08	14.10	19.94	29.97	6.69	11.83	19.38	1.85	3.46	5.71	0
Increase in electricity demand (MWH/day)	55.06	103.90	205.16	79.41	107.72	153.84	36.04	64.51	105.61	7.99	15.62	25.59	0
Increase in natural gas demand (MMCF/day)	0.60	1.16	2.33	0.72	0.99	1.46	0.39	0.68	1.08	0.88	0.98	1.09	0

Notes: Values shown represent change from projected No-Action Alternative conditions in each year as a result of implementing that alternative.
(a) The No-Action Alternative values summarize influencing factors relative to the projected closure conditions for each period of analysis.
MGD = million gallons/day
MMCF = million cubic feet
MWH = megawatt-hours

Table 2.7-2. Summary of Substantial Adverse Environmental Impacts and Suggested Mitigations for the Proposed Action and Reasonable Reuse Alternatives
Page 1 of 9

Resource Category	Proposed Action	International Waypoint Alternative	Commercial Aviation Alternative	Recreation Alternative	No-Action Alternative
Local Community					
• Land Use and Aesthetics	• **Impacts:** Visual quality could be impacted by proposed industrial development	• **Impacts:** No impacts	• **Impacts:** No impacts	• **Impacts:** No impacts	• **Impacts:** No impacts
	• **Mitigation:** Use of landscape screening	• **Mitigation:** No mitigation required	• **Mitigation:** No mitigation required	• **Mitigation:** No mitigation required	• **Mitigation:** No mitigation required
• Transportation (Surface)	• **Impacts:** Increase of 33,800 daily vehicular trips. Three new access points. Segments of CR 553 could drop to unacceptable Levels of Service	• **Impacts:** Increase of 30,250 daily vehicular trips. One new access point. CR 462 could drop to unacceptable Levels of Service	• **Impacts:** Increase of 20,550 daily vehicular trips. No new access points. No road segments would drop to unacceptable Levels of Service	• **Impacts:** Increase of 6,050 daily vehicular trips. No new access points. No road segments would drop to unacceptable Levels of Service	• **Impacts:** No impacts
	• **Mitigation:** Widening of roads or providing intersection channelization and signalization would increase Level of Service to acceptable conditions	• **Mitigation:** Same as Proposed Action	• **Mitigation:** No mitigation required	• **Mitigation:** No mitigation required	• **Mitigation:** No mitigation required
• Transportation (Airspace)	• **Impacts:** No Impacts	• **Impacts:** No Impacts	• **Impacts:** No Impacts	• **Impacts:** No Impacts	• **Impacts:** No aircraft operations. No change in regional airspace
	• **Mitigation:** No mitigation required	• **Mitigation:** No mitigation required	• **Mitigation:** No mitigation required	• **Mitigation:** No mitigation required	• **Mitigation:** No mitigation required

Note: Impacts are based on the changes from closure baseline conditions, which are projected to occur as a result of implementing that alternative.
CR = County Road

Table 2.7-2. Summary of Substantial Adverse Environmental Impacts and Suggested Mitigations for the Proposed Action and Reasonable Reuse Alternatives
Page 2 of 9

Resource Category	Proposed Action	International Wayport Alternative	Commercial Aviation Alternative	Recreation Alternative	No-Action Alternative
Local Community (Continued) • Utilities	• **Impacts:** No impacts • **Mitigation:** No mitigation required	• **Impacts:** No impacts • **Mitigation:** No mitigation required	• **Impacts:** No impacts • **Mitigation:** No mitigation required	• **Impacts:** No impacts • **Mitigation:** No mitigation required	• **Impacts:** No change in base-related utility use • **Mitigation:** No mitigation required
Hazardous Materials and Hazardous Waste Management • Hazardous Materials Management	• **Impacts:** Quantities of various materials used • **Mitigation:** Follow pollution prevention practices	• **Impacts:** Same as Proposed Action • **Mitigation:** Same as Proposed Action	• **Impacts:** Same as Proposed Action • **Mitigation:** Same as Proposed Action	• **Impacts:** Same as Proposed Action • **Mitigation:** Same as Proposed Action	• **Impacts:** No change in types and quantities used • **Mitigation:** No mitigation required
• Hazardous Waste Management	• **Impacts:** Quantities of various wastes generated • **Mitigation:** Follow waste minimization and pollution prevention practices Follow recommendations of Bi-National Program to Restore and Protect the Lake Superior Basin	• **Impacts:** Same as Proposed Action • **Mitigation:** Same as Proposed Action	• **Impacts:** Same as Proposed Action • **Mitigation:** Same as Proposed Action	• **Impacts:** Same as Proposed Action • **Mitigation:** Same as Proposed Action	• **Impacts:** No change in quantities generated. • **Mitigation:** No mitigation required

Note: Impacts are based on the changes from closure baseline conditions, which are projected to occur as a result of implementing that alternative.

Table 2.7-2. Summary of Substantial Adverse Environmental Impacts and Suggested Mitigations for the Proposed Action and Reasonable Reuse Alternatives
Page 3 of 9

Resource Category	Proposed Action	International Wayport Alternative	Commercial Aviation Alternative	Recreation Alternative	No-Action Alternative
Hazardous Materials and Hazardous Waste Management (Continued)					
• Installation Restoration Program	• **Impacts:** No adverse environmental impacts; however possible redevelopment delays and land use restrictions due to remediation	• **Impacts:** Same as Proposed Action	• **Impacts:** Same as Proposed Action	• **Impacts:** Same as Proposed Action	• **Impacts:** IRP remediation activities completed or continued as required
	• **Mitigation:** Coordinate IRP and construction activities Reuse some sites as open space, greenbelts, or parks	• **Mitigation:** Same as Proposed Action	• **Mitigation:** Same as Proposed Action	• **Mitigation:** Same as Proposed Action	• **Mitigation:** No mitigation required
• Storage Tanks	• **Impacts:** No impacts	• **Impacts:** No impacts	• **Impacts:** No impacts	• **Impacts:** No impacts	• **Impacts:** No impacts
	• **Mitigation:** No mitigation required	• **Mitigation:** No mitigation required	• **Mitigation:** No mitigation required	• **Mitigation:** No mitigation required	• **Mitigation:** No mitigation required
• Asbestos	• **Impacts:** Increase in renovation and demolition of existing structures that contain asbestos	• **Impacts:** Same as Proposed Action	• **Impacts:** Same as Proposed Action	• **Impacts:** Same as Proposed Action	• **Impacts:** No impact with management of asbestos in accordance with Air Force policy

Note: Impacts are based on the changes from closure baseline conditions, which are projected to occur as a result of implementing that alternative.
IRP = Installation Restoration Program

Table 2.7-2. Summary of Substantial Adverse Environmental Impacts and Suggested Mitigations for the Proposed Action and Reasonable Reuse Alternatives
Page 4 of 9

Resource Category	Proposed Action	International Wayport Alternative	Commercial Aviation Alternative	Recreation Alternative	No-Action Alternative
Hazardous Materials and Hazardous Waste Management (Continued)					
• Asbestos (Continued)	• **Mitigation:** None needed if coordination of asbestos removal or management during renovation and demolition activities is accomplished. Advise recipients of potential hazards	• **Mitigation:** Same as Proposed Action	• **Mitigation:** Same as Proposed Action	• **Mitigation:** Same as Proposed Action	• **Mitigation:** No mitigation required
• Pesticide Usage	• **Impacts:** Use associated with proposed reuse	• **Impacts:** Same as Proposed Action	• **Impacts:** Same as Proposed Action	• **Impacts:** Same as Proposed Action	• **Impacts:** No change in usage or management practices
	• **Mitigation:** No mitigation required	• **Mitigation:** No mitigation required	• **Mitigation:** No mitigation required	• **Mitigation:** No mitigation required	• **Mitigation:** No mitigation required
• Polychlorinated Biphenyls	• **Impacts:** No impact. All regulated PCB equipment has been removed	• **Impacts:** Same as Proposed Action	• **Impacts:** Same as Proposed Action	• **Impacts:** Same as Proposed Action	• **Impacts:** Same as Proposed Action
	• **Mitigation:** No mitigation required	• **Mitigation:** No mitigation required	• **Mitigation:** No mitigation required	• **Mitigation:** No mitigation required	• **Mitigation:** No mitigation required

Note: Impacts are based on the changes from closure baseline conditions, which are projected to occur as a result of implementing that alternative.
PCB = polychlorinated biphenyls

Table 2.7-2. Summary of Substantial Adverse Environmental Impacts and Suggested Mitigations for the Proposed Action and Reasonable Reuse Alternatives
Page 5 of 9

Resource Category	Proposed Action	International Wayport Alternative	Commercial Aviation Alternative	Recreation Alternative	No-Action Alternative
Hazardous Materials and Hazardous Waste Management (Continued)					
• Radon	• **Impacts:** No impact. Current levels below 4 pCi/l	• **Impacts:** Same as Proposed Action	• **Impacts:** Same as Proposed Action	• **Impacts:** Same as Proposed Action	• **Impacts:** Same as Proposed Action
	• **Mitigation:** No mitigation required	• **Mitigation:** No mitigation required	• **Mitigation:** No mitigation required	• **Mitigation:** No mitigation required	• **Mitigation:** No mitigation required
• Medical/Biohazardous Waste	• **Impacts:** Small amounts generated with clinic	• **Impacts:** Same as Proposed Action	• **Impacts:** Small amounts generated with first aid training	• **Impacts:** No impact. None generated	• **Impacts:** No impact. None generated
	• **Mitigation:** No mitigation required	• **Mitigation:** No mitigation required	• **Mitigation:** No mitigation required	• **Mitigation:** No mitigation required	• **Mitigation:** No mitigation required
• Ordnance	• **Impacts:** No impact. Ranges cleared prior to disposal. No impact from reuse of the small arms firing range if properly maintained	• **Impacts:** Same as Proposed Action	• **Impacts:** Same as Proposed Action	• **Impacts:** No impact. Ranges cleared prior to disposal	• **Impacts:** No impact
	• **Mitigation:** No mitigation required	• **Mitigation:** No mitigation required	• **Mitigation:** No mitigation required	• **Mitigation:** No mitigation required	• **Mitigation:** No mitigation required

Note: Impacts are based on the changes from closure baseline conditions, which are projected to occur as a result of implementing that alternative.
pCi/l = picocuries per liter

Table 2.7-2. Summary of Substantial Adverse Environmental Impacts and Suggested Mitigations for the Proposed Action and Reasonable Reuse Alternatives
Page 6 of 9

Resource Category	Proposed Action	International Waypoint Alternative	Commercial Aviation Alternative	Recreation Alternative	No-Action Alternative
Hazardous Materials and Hazardous Waste Management (Continued) • Lead-Based Paint	• **Impacts:** Potential exposure to lead-based paint in facilities constructed prior to or during 1978 • **Mitigation:** Advise recipients of potential hazard. No mitigation required if coordination of lead-based paint removal is in conjunction with construction and renovation activities	• **Impacts:** Same as Proposed Action • **Mitigation:** Same as Proposed Action	• **Impacts:** Same as Proposed Action • **Mitigation:** Same as Proposed Action	• **Impacts:** Same as Proposed Action • **Mitigation:** Same as Proposed Action	• **Impacts:** No impact if managed in accordance with Air Force policy • **Mitigation:** No mitigation required
Natural Environment • Geology and Soils	• **Impacts:** Erosion effects from 681 acres of ground disturbance • **Mitigation:** Use of cover and limiting exposure time would minimize erosion effects	• **Impacts:** Minor erosion effects from 380 acres of ground disturbance • **Mitigation:** Same as Proposed Action	• **Impacts:** Minor erosion effects from 259 acres of ground disturbance • **Mitigation:** Same as Proposed Action	• **Impacts:** Minor erosion effects from 201 acres of ground disturbance • **Mitigation:** Same as Proposed Action	• **Impacts:** No impact • **Mitigation:** No mitigation required

Note: Impacts are based on the changes from closure baseline conditions, which are projected to occur as a result of implementing that alternative.

Table 2.7-2. Summary of Substantial Adverse Environmental Impacts and Suggested Mitigations for the Proposed Action and Reasonable Reuse Alternatives
Page 7 of 9

Resource Category	Proposed Action	International Wayport Alternative	Commercial Aviation Alternative	Recreation Alternative	No-Action Alternative
Natural Environment (Continued) • Water Resources	• **Impacts:** Surface water runoff from 681 acres of ground disturbance Reuse of base wells in housing may cause lowering of water levels in lakes east of the base • **Mitigation:** Control of runoff, minimizing exposure time and area, and use of landscaping could reduce effects of runoff on water quality. Implementation of a wellhead protection program To mitigate lowering lakes, find alternate water supplies or reduce the yield of water from existing wells to an acceptable level Follow recommendations of Bi-National Program to Restore and Protect the Lake Superior Basin	• **Impacts:** Surface water runoff from 380 acres of ground disturbance Same as Proposed Action • **Mitigation:** Same as Proposed Action	• **Impacts:** Surface water runoff from 259 acres of ground disturbance Same as Proposed Action • **Mitigation:** Same as Proposed Action	• **Impacts:** Surface water runoff from 201 acres of ground disturbance Same as Proposed Action • **Mitigation:** Same as Proposed Action	• **Impacts:** No impact • **Mitigation:** No mitigation required

Note: Impacts are based on the changes from closure baseline conditions, which are projected to occur as a result of implementing that alternative.

Table 2.7-2. Summary of Substantial Adverse Environmental Impacts and Suggested Mitigations for the Proposed Action and Reasonable Reuse Alternatives

Resource Category	Proposed Action	International Wayport Alternative	Commercial Aviation Alternative	Recreation Alternative	No-Action Alternative
Natural Environment (Continued)					
• Air Quality	• **Impacts:** Regional emissions will not exceed NAAQS or affect attainment status, or otherwise cause substantial air quality degradation	• **Impacts:** Same as Proposed Action	• **Impacts:** Same as Proposed Action	• **Impacts:** Same as Proposed Action	• **Impacts:** No impact
	• **Mitigation:** No mitigation required	• **Mitigation:** No mitigation required	• **Mitigation:** No mitigation required	• **Mitigation:** No mitigation required	• **Mitigation:** No mitigation required
• Noise	• **Impacts:** 424 acres and no residents exposed to DNL 65 dB or greater due to aircraft operations in 2015. 184 additional residents exposed to DNL 65 dB or greater due to surface traffic noise	• **Impacts:** 948 acres and no residents exposed to DNL 65 dB or greater due to aircraft operations in 2015. 136 additional residents exposed to DNL 65 dB or greater due to surface traffic noise	• **Impacts:** 125 acres and no residents exposed to DNL 65 dB or greater due to aircraft operations in 2015. 112 additional residents exposed to DNL 65 dB or greater due to surface traffic noise	• **Impacts:** 39 additional residents exposed to DNL 65 dB or greater due to surface traffic noise	• **Impacts:** No impact
	• **Mitigation:** Change takeoff climbout and landing procedures to minimize aircraft noise. Restrict development in high noise areas. Manage aircraft activities to reduce noise levels Increase sound insulation in existing buildings to minimize traffic noise	• **Mitigation:** Same as Proposed Action	• **Mitigation:** Same as Proposed Action	• **Mitigation:** Increase sound insulation in existing buildings to minimize traffic noise	• **Mitigation:** No mitigation required

Note: Impacts are based on the changes from closure baseline conditions, which are projected to occur as a result of implementing that alternative.
dB = decibel
DNL = day-night average sound level
NAAQS = National Ambient Air Quality Standards

Table 2.7-2. Summary of Substantial Adverse Environmental Impacts and Suggested Mitigations for the Proposed Action and Reasonable Reuse Alternatives
Page 9 of 9

Resource Category	Proposed Action	International Wayport Alternative	Commercial Aviation Alternative	Recreation Alternative	No-Action Alternative
Natural Environment (Continued)					
• Biological Resources	• **Impacts:** Potential impact to 0 to 2.5 acres of wetlands[a] No impacts to threatened or endangered species	• **Impacts:** Potential impact to 2 to 8.5 acres of wetlands[b] No impacts to threatened or endangered species	• **Impacts:** Potential impact to 0 to 9.5 acres of wetlands[a] No impacts to threatened or endangered species	• **Impacts:** Potential impact to 0 to 2.5 acres of wetlands[a] No impacts to threatened or endangered species	• **Impacts:** Beneficial impacts may occur over time due to reduced human activity
	• **Mitigation:** Wetlands mitigation could include avoidance through facility design; replacement, enhancement of wetland habitat; or control of construction-related erosion into nearby wetlands. Development of soil erosion and sedimentation control plan in accordance with applicable regulations	• **Mitigation:** Same as Proposed Action	• **Mitigation:** Same as Proposed Action	• **Mitigation:** Same as Proposed Action	• **Mitigation:** No mitigation required
• Cultural Resources	• **Impacts:** Potential adverse effects to two prehistoric sites eligible for listing in the NRHP	• **Impacts:** Same as Proposed Action	• **Impacts:** Same as Proposed Action	• **Impacts:** Same as Proposed Action	• **Impacts:** No impact
	• **Mitigation:** Historic properties on Air Force fee-owned property may be conveyed to nonfederal owners with preservation covenants. Consult with SHPO and Advisory Council on Historic Preservation in development and implementation of mitigation strategies	• **Mitigation:** Same as Proposed Action	• **Mitigation:** Same as Proposed Action	• **Mitigation:** Same as Proposed Action	• **Mitigation:** No mitigation required

Notes: Impacts are based on the changes from closure baseline conditions, which are projected to occur as a result of implementing that alternative.
(a) Likely wetland impact is 0 acres.
(b) Likely wetland impact is 2 acres.
NRHP = National Register of Historic Places
SHPO = State Historic Preservation Officer

Table 2.7-3. Summary of Impacts from Other Land Use Concepts
Page 1 of 7

Resource Category	Michigan Army National Guard	Correctional Institution	Sawmill	Waste to Energy/ Recycling	Waste to Energy/ Environmental Support Operations
Local Community					
Land Use and Aesthetics	Compatible with adjacent land uses. No visual impacts	Compatible with adjacent land uses. No visual impacts	**Operation.** Compatible with adjacent land uses. No visual impacts **Harvest.** No change in land use. Potential for visual and recreational impacts from increased timber harvesting. Clear cutting would produce the most effects	Compatible with adjacent land uses. No visual impacts	Compatible with adjacent land uses. No visual impacts
Transportation	150 weekend trips. Potential changes in traffic volume would not affect Level of Service	650 daily trips. Changes in traffic volume may affect Level of Service	**Operation.** 60 vehicles per hour during peak hour. Changes in traffic volume would have little effect on Level of Service **Harvest.** 20 truck loads of timber transported per day. Increase in volume would have little effect on Level of Service	50 vehicles per hour during peak hour. Changes in traffic volume would have little effect on Level of Service	70 vehicles per hour during peak hour. Changes in traffic volume would have little effect on Level of Service

Note: Implementation of these other land use concepts in conjunction with the Proposed Action or alternatives may require the use of the same suggested mitigation measures for each resource area in Table S-2.

Table 2.7-3. Summary of Impacts from Other Land Use Concepts
Page 2 of 7

Resource Category	Michigan Army National Guard	Correctional Institution	Sawmill	Waste to Energy/ Recycling	Waste to Energy/ Environmental Support Operations
Local Community (Continued)					
Utilities	Potential changes in utility use would not exceed system capacities	Potential changes in utility use would not exceed system capacities	**Operation.** Potential changes in utility use would not exceed system capacities **Harvest.** No impact.	Potential changes in utility use would not exceed system capacities. Net reduction in solid waste generation and electrical use	Potential changes in utility use would not exceed system capacities. Net reduction in solid waste generation and electrical use
Hazardous Materials and Hazardous Waste Management					
Hazardous Materials Management	Small amounts used during maintenance activities. Management in compliance with applicable regulations	Small amounts used during maintenance activities. Management in compliance with applicable regulations	**Operation.** Small amounts used during maintenance activities. Management in compliance with applicable regulations **Harvest.** Increase use of fuel, antifreeze, and lubricants for harvesting equipment.	Small amounts used during maintenance activities. Management in compliance with applicable regulations	Small amounts used during maintenance activities. Management in compliance with applicable regulations

Note: Implementation of these other land use concepts in conjunction with the Proposed Action or alternatives may require the use of the same suggested mitigation measures for each resource area in Table S-2.

Table 2.7-3. Summary of Impacts from Other Land Use Concepts
Page 3 of 7

Resource Category	Michigan Army National Guard	Correctional Institution	Sawmill	Waste to Energy/ Recycling	Waste to Energy/ Environmental Support Operations
Hazardous Materials and Hazardous Waste Management (Continued)					
Hazardous Waste Management	Small quantities generated by maintenance activities. Management of waste in compliance with applicable regulations	Small quantities generated by maintenance activities. Management of waste in compliance with applicable regulations	**Operation.** Small quantities generated by maintenance activities. Management of waste in compliance with applicable regulations **Harvest.** Increased potential for fuel, antifreeze, and lubricant leaks from harvesting equipment	Small quantities generated by maintenance activities. Transportation and storage of waste from recycling operations. Management of waste in compliance with applicable regulations	Small quantities generated by maintenance activities. Transportation and storage of waste from off-site cleanup operations. Management of waste in compliance with applicable regulations
Installation Restoration Program	No impact	No impact	**Operation.** No impact **Harvest.** No impact	No impact	No impact
Storage Tanks	No impact	No impact	**Operation.** No impact **Harvest.** No impact	No impact	No impact

Note: Implementation of these other land use concepts in conjunction with the Proposed Action or alternatives may require the use of the same suggested mitigation measures for each resource area in Table S-2.

Table 2.7-3. Summary of Impacts from Other Land Use Concepts
Page 4 of 7

Resource Category	Michigan Army National Guard	Correctional Institution	Sawmill	Waste to Energy/ Recycling	Waste to Energy/ Environmental Support Operations
Hazardous Materials and Hazardous Waste Management (Continued)					
Asbestos	May require management of asbestos-containing material in accordance with the National Emissions Standards for Hazardous Air Pollutants	No impact	**Operation.** May require management of asbestos-containing material in accordance with the National Emissions Standards for Hazardous Air Pollutants **Harvest.** No impact	May require management of asbestos-containing material in accordance with the National Emissions Standards for Hazardous Air Pollutants	May require management of asbestos-containing material in accordance with the National Emissions Standards for Hazardous Air Pollutants
Pesticide Usage	Small quantities used. Management in accordance with applicable regulations	Small quantities used. Management in accordance with applicable regulations	**Operation.** Small quantities used. Management in accordance with applicable regulations **Harvest.** Increased use of pesticides for site preparation. Use in accordance with applicable regulations	Small quantities used. Management in accordance with applicable regulations	Small quantities used. Management in accordance with applicable regulations
Polychlorinated Biphenyls	No impact	No impact	**Operation.** No impact **Harvest.** No impact	No impact	No impact

Note: Implementation of these other land use concepts in conjunction with the Proposed Action or alternatives may require the use of the same suggested mitigation measures for each resource area in Table S-2.

Table 2.7-3. Summary of Impacts from Other Land Use Concepts
Page 5 of 7

Resource Category	Michigan Army National Guard	Correctional Institution	Sawmill	Waste to Energy/ Recycling	Waste to Energy/ Environmental Support Operations
Hazardous Materials and Hazardous Waste Management (Continued)					
Radon	No impact	No impact	**Operation.** No impact **Harvest.** No impact	No impact	No impact
Medical/Biohazardous Waste	None generated	Managed in accordance with applicable regulations	**Operation.** None generated **Harvest.** No impact	None generated	None generated
Ordnance	Small amounts used with arms proficiency training. Spent shells managed in accordance with applicable regulations	No impact	**Operation.** No impact **Harvest.** No impact	No impact	No impact
Lead-Based Paint	May require management of lead-based paint in accordance with applicable regulations	No impact	**Operation.** May require management of lead-based paint in accordance with applicable regulations **Harvest.** No impact	May require management of lead-based paint in accordance with applicable regulations	May require management of lead-based paint in accordance with applicable regulations

Note: Implementation of these other land use concepts in conjunction with the Proposed Action or alternatives may require the use of the same suggested mitigation measures for each resource area in Table S-2.

Table 2.7-3. Summary of Impacts from Other Land Use Concepts
Page 6 of 7

Resource Category	Michigan Army National Guard	Correctional Institution	Sawmill	Waste to Energy/ Recycling	Waste to Energy/ Environmental Support Operations
Natural Environment					
Geology and Soils	Minor ground disturbance associated with driver training of equipment	Up to 161 acres of ground disturbance Potential increase in soil erosion	**Operation.** Ground disturbance of up to 2 acres during construction **Harvest.** Increased soil disturbance and sedimentation from harvest management	No impact	No impact
Water Resources	Minor increase in sediment loading. No adverse impact due to change in water demand	Potential increase in sediment loading during construction. No adverse impact due to change in water demand	**Operation.** Potential increase in sediment loading during construction. No adverse impact due to change in water demand **Harvest.** Localized water quality impacts from increased sedimentation and removal of vegetation	No adverse impact due to change in water demand	Potential for minor increase in sediment loading during construction. No adverse impact due to change in water demand
Air Quality	No impact	No impact	**Operation.** No impact **Harvest.** No impact	No impact	No impact

Note: Implementation of these other land use concepts in conjunction with the Proposed Action or alternatives may require the use of the same suggested mitigation measures for each resource area in Table S-2.

Table 2.7-3. Summary of Impacts from Other Land Use Concepts
Page 7 of 7

Resource Category	Michigan Army National Guard	Correctional Institution	Sawmill	Waste to Energy/ Recycling	Waste to Energy/ Environmental Support Operations
Natural Environment (Continued)					
Noise	No impact	No impact	**Operation.** No impact **Harvest.** Increased noise levels to recreational areas from timber harvesting activities	No impact	No impact
Biological Resources	Potential impact to 5 acres of wetlands. No impact to threatened or endangered species	Potential impact to wetlands along eastern boundary of the site. No impact to threatened or endangered species	**Operation.** Potential impact to small drainage ditch wetland areas. No impact to threatened or endangered species **Harvest.** Increased loss of wildlife habitat could affect some species populations	No impact	No impact
Cultural Resources	No impact	No impact	**Operation.** No impact **Harvest.** Potential for increased damage to unidentified cultural resource sites on state and private lands	No impact	No impact

Note: Implementation of these other land use concepts in conjunction with the Proposed Action or alternatives may require the use of the same suggested mitigation measures for each resource area in Table S-2.

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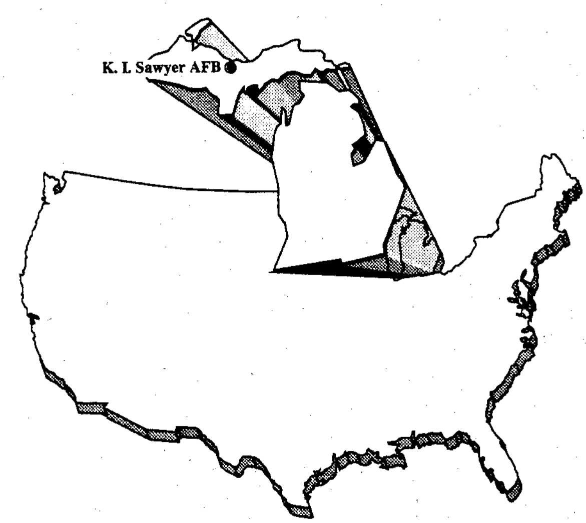


CHAPTER 3
AFFECTED ENVIRONMENT

3.0 AFFECTED ENVIRONMENT

3.1 INTRODUCTION

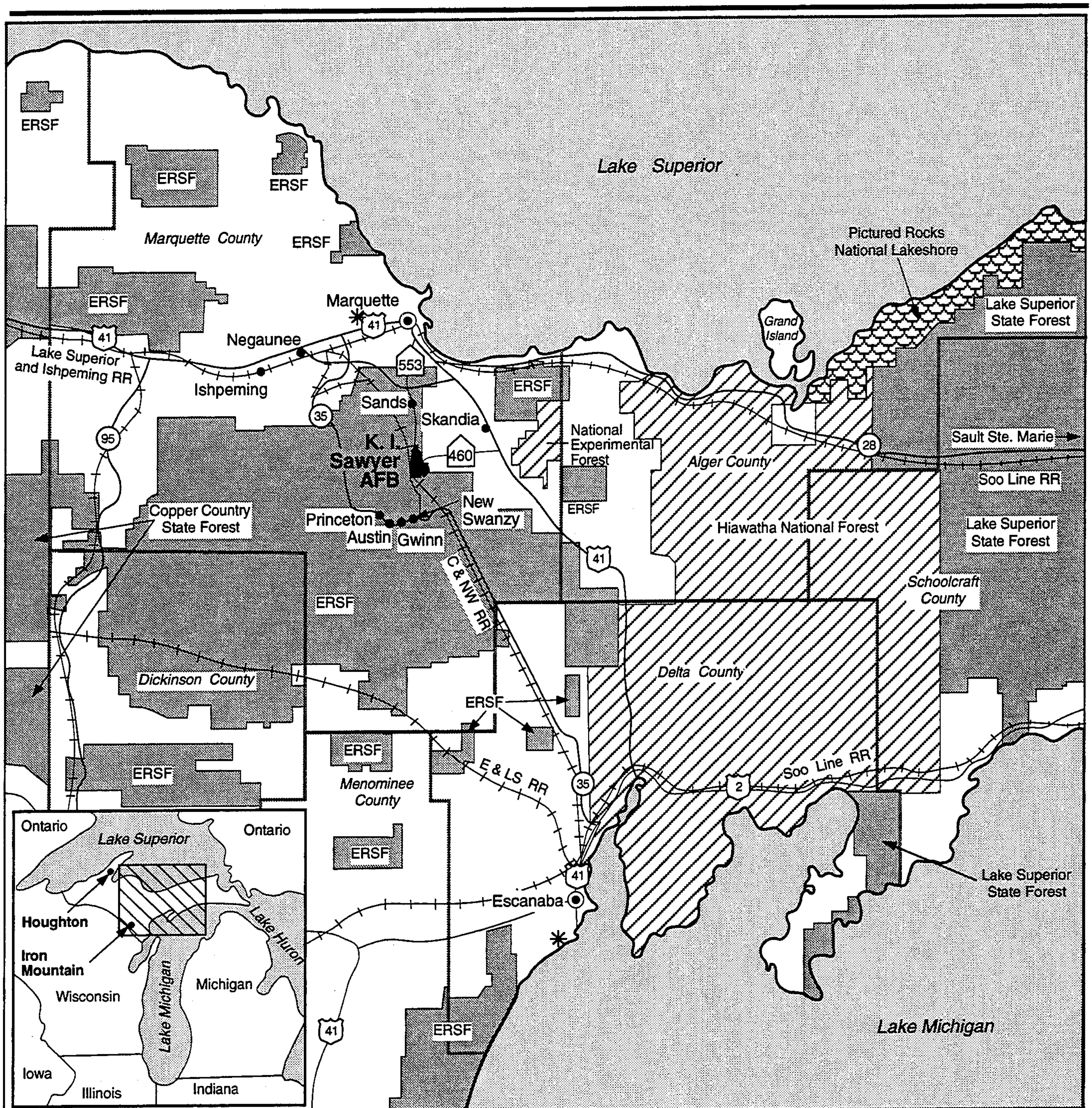
This chapter describes the environmental conditions of K. I. Sawyer AFB and its Region of Influence (ROI) as it would be at the time of base closure. The information provided serves as a baseline from which to identify and evaluate environmental changes resulting from disposal and reuse of K. I. Sawyer AFB. Although this EIS focuses on the biophysical environment, some nonbiophysical elements are addressed. The nonbiophysical elements (influencing factors) of population and employment, land use and aesthetics, transportation networks, and public utility systems in the region and local communities are addressed. This chapter also describes the storage, use, and management of hazardous materials and waste found on base, including storage tanks, asbestos, pesticides, polychlorinated biphenyls (PCBs), radon, medical/biohazardous waste, ordnance, and lead-based paint. The current status of the IRP is also described. In addition, the chapter describes the pertinent natural resources of geology and soils, water resources, air quality, noise, biological resources, and cultural resources. Finally, the chapter provides the demographic analysis for Environmental Justice.

The ROI to be studied will be defined for each resource area affected by the Proposed Action and alternatives. The ROI determines the geographical area to be addressed as the Affected Environment. Although the base boundary may constitute the ROI limit for many resources, potential impacts associated with certain issues (e.g., air quality, utility systems, water resources) transcend these limits.

The baseline conditions assumed for the purposes of analysis are the conditions projected at base closure in September 1995. Impacts associated with disposal and/or reuse activities may then be addressed by comparing projected conditions under various reuses to closure conditions. A reference to preclosure conditions is given where appropriate (e.g., air quality) to provide a comparative analysis over time. Data used to describe the preclosure reference point are those that depict conditions as close as possible to the closure announcement date. This will assist the decision maker and agencies in understanding potential long-term impacts in comparison to conditions when the installation was active.

3.2 LOCAL COMMUNITY

K. I. Sawyer AFB is in the Upper Peninsula of Michigan in a rural, sparsely populated section of Marquette County, approximately 20 miles south of Marquette and 5 miles north of Gwinn, Michigan (Figure 3.2-1). The base property encompasses 4,923 acres, which includes Air Force fee-owned



EXPLANATION

Airport	National Forest
U.S. Highway	State Forest
State Highway	ERSF Escanaba River State Forest
County Road	E & LS Escanaba and Lake Superior
	C & NW Chicago and Northwestern

0 3.5 7 14 Miles

Regional Map

Figure 3.2-1

land, and land leased from the state of Michigan and county of Marquette (see Figure 1.2-1). The acreage for each type of land interest is presented in Table 3.2-1. An additional 291 acres of land adjacent to the base property consist of various aviation easements (239 acres) and easements for railway, utility, and road access (52 acres).

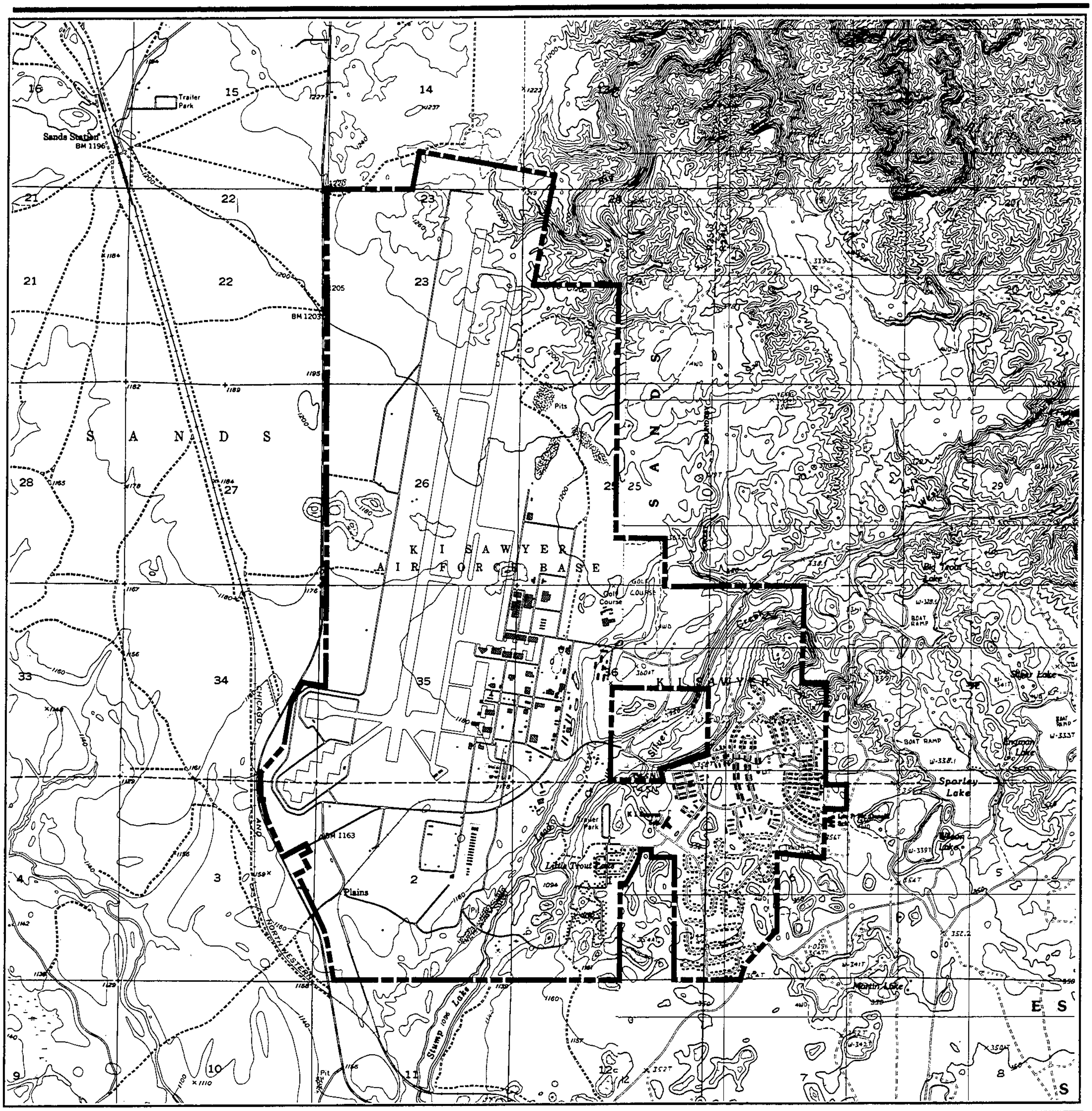
Table 3.2-1. Air Force Real Estate Interests on K. I. Sawyer AFB

Interest Type	Acreage	Percent of Base
Air Force fee-owned	2,762	56
Lease	2,001	41
Public domain (Department of the Interior)	160	3
Total	4,923	100

The topography of K. I. Sawyer AFB and the surrounding area of the Upper Peninsula consists of rolling hills with numerous lakes and streams (Figure 3.2-2). Elevations at the base vary only 194 feet, from approximately 1,066 feet above mean sea level (MSL) near Silver Lead Creek in the southeastern portion of the base to 1,260 feet above MSL near the northern base boundary. The base is surrounded by forest with the Escanaba River State Forest bordering three sides of the base. Marquette County and the surrounding areas along Lake Superior are popular resort areas, offering fishing, hunting, boating, skiing, snowmobiling, camping, and other recreational opportunities.

The climate in the Upper Peninsula is dominated by continental polar air masses, characterized by cold winters and short, mild summers and is influenced considerably by the proximity of Lake Superior. As a consequence of the cool expanse of Lake Superior in the summer, there is rarely a long period of hot weather. In the winter, cold periods are tempered by the waters if the lake is unfrozen. However, winds blowing across the lake pick up moisture and cause cloudy weather throughout the winter, as well as frequent periods of snow flurries, which are intensified near the upslope areas. The coolest month of the year is January, with a mean monthly temperature of 12 degrees Fahrenheit (°F), and the warmest month of the year is July, with a mean monthly temperature of 64°F. Precipitation at K. I. Sawyer AFB averages 34 inches annually, and is evenly distributed throughout the year. Snowfall in the region occurs mainly from late October through April and averages approximately 135 inches.

The principal roadway serving K. I. Sawyer AFB is CR 553, a north-south rural road adjacent to the west boundary of the base, which connects the



EXPLANATION

Base Boundary

K. I. Sawyer AFB and Vicinity

0 1000 2000 4000 Feet

Source: U.S.G.S. 7.5 min.
Harvey, MI 1985, Little Lake, MI 1985,
Sands, MI 1975, Gwinn, MI 1975

Figure 3.2-2

base with Marquette 20 miles to the north and State Highway (SH) 35 at Gwinn 5 miles to the south. U.S. 41, approximately 15 miles east of K. I. Sawyer AFB, connects Marquette with the city of Escanaba to the south.

Commercial airports near K. I. Sawyer AFB are in Marquette and Escanaba, which are approximately 28 miles north and 55 miles south of the base, respectively. Freight rail service to K. I. Sawyer AFB is provided by the Chicago and Northwestern railroad, which provides service between Chicago and Ishpeming; there is no passenger rail service. The railroad spur that connects the base with the main rail line is owned by Chicago and Northwestern and is kept operational.

Installation Background. The site that is currently K. I. Sawyer AFB was first established as K. I. Sawyer County Airport in 1949, as a municipal airport for Marquette County. On January 24, 1955, the U.S. Government signed a 99-year lease establishing K. I. Sawyer AFB at the site of the county airport. The county airport was named in honor of Kenneth Ingalls Sawyer, a former Marquette County Highway Department Superintendent. Joint use between the county and the U.S. Government began in 1955, and the site was transferred to Air Force control in 1956. Non-military operations ceased in 1957.

On January 8, 1956, K. I. Sawyer AFB became the home of the 473rd Fighter Group, a unit of the Eastern Air Defense Force (Air Defense Command). In October 1959, the 473rd Fighter Group became the 56th Fighter Group and was host to two major tenants: the Sault Ste. Marie Air Defense Sector and the 4042nd Strategic Wing, a Strategic Air Command (SAC) unit that formed the basis for the present day bomb wing.

In February 1963, the 4042nd Strategic Wing was discontinued and the 410th Bombardment Wing, now called the 410th Bomb Wing, was activated. Since 1963, the Wing has conducted operations using the B-52H Stratofortress and the KC-135A Stratotanker. In June 1992, K. I. Sawyer AFB came under the control of Air Combat Command (ACC) with the disestablishment of SAC.

3.2.1 Community Setting

The area surrounding K. I. Sawyer AFB is a popular Michigan resort and vacation area with mostly small, unincorporated communities dispersed throughout county townships. The ROI for employment and population effects for communities potentially affected by base disposal and reuse comprises the two counties of Marquette and Delta. However, the effects of reuse are not expected to occur proportionately between both counties. Rather, greater population and employment effects from closure and reuse of the base are projected to occur in Marquette County. Since the base is within three townships in Marquette County, most of the population effects

will be localized in this area, i.e., Forsyth, Sands, and West Branch townships. The cities of Marquette, Ishpeming, and Negaunee also are expected to experience some effects of closure and reuse. These communities are highlighted in the analysis, as appropriate.

Total employment in the ROI was measured at 52,162 in 1991, was estimated at 53,450 in 1992 (NPA Data Services, Inc., 1993), and is projected to decline to 53,159 at base closure in 1995. Overall employment in the ROI increased 1.5 percent annually between 1970 and 1991. The national and state average growth rates for employment were 1.3 percent and 2.0 percent, respectively, during the same period. Major employment sectors in the ROI are government, services, and retail trade. In 1991, government provided 26.2 percent of the jobs in the ROI.

Population in the ROI was about 109,500 in 1991, was estimated at 112,161 in 1992 (NPA Data Services, Inc., 1993), and is projected to decline to 103,322 at base closure. Population in Marquette County was about 71,400 in 1991, was estimated at 73,185 in 1992, and is projected to be 64,005 at base closure. Populations in Forsyth, Sands, and West Branch townships were estimated at 9,059, 2,783, and 2,314, respectively, in 1992 and are projected to be 3,268, 1,469, and 651, respectively, at base closure. The base has two principal support communities, the unincorporated community of Gwinn and the city of Marquette. Population effects in Gwinn are not analyzed separately, but are included in the Forsyth Township analysis. The city of Marquette had an estimated 1992 population of 22,689, which is projected to be 22,322 at base closure. Ishpeming and Negaunee had estimated 1992 populations of 7,433 and 4,895, respectively; these figures are projected to be 7,493 and 4,868, respectively, by base closure.

Delta County's 1991 population was about 38,100, was estimated at 38,976 in 1992, and is projected to be 39,317 in 1995. Most of the population effects in Delta County are expected to be felt by secondary workers and their families as a result of changes in procurement spending by the base.

Total off-base housing units in the ROI numbered 47,172 in 1990, having increased at an average of 162 units (0.4 percent) annually since 1980. West Branch Township experienced the greatest rate of increase in housing stock (3.3 percent) in the ROI. Growth of Sands Township housing stock was second largest in the ROI, at 2.0 percent. Forsyth Township and the cities of Marquette, Ishpeming, and Negaunee all experienced housing stock declines of 0.1 to 0.4 percent annually, due to demolition of older units and removal of mobile homes. Delta County showed an average annual increase in housing stock of 0.6 percent. The overall "flat" trend in the ROI housing stock is consistent with the decreases in population between 1980 and 1990.

The estimated base-related employment in 1992 consisted of 4,567 direct (U.S. Air Force, 1992b) and 1,171 secondary jobs. By September 1995, employment associated with the base is expected to decrease to 50 direct employees, all associated with caretaker activities of the OL. These jobs are expected to create an additional 13 secondary jobs as a result of direct worker and procurement spending.

3.2.2 Land Use and Aesthetics

This section describes the land uses and aesthetics for the base property and the surrounding areas of K. I. Sawyer AFB at base closure. Projected land uses in the vicinity of the base at closure are assumed to be similar to existing land uses. The ROI includes the base property and potentially affected adjacent properties within the jurisdiction of Sands, Forsyth, and West Branch townships in Marquette County.

K. I. Sawyer AFB property is owned by the U.S. Government (Air Force and DOI), state of Michigan, and Marquette County, and is within the jurisdiction of Sands, Forsyth, and West Branch townships (Figure 3.2-3).

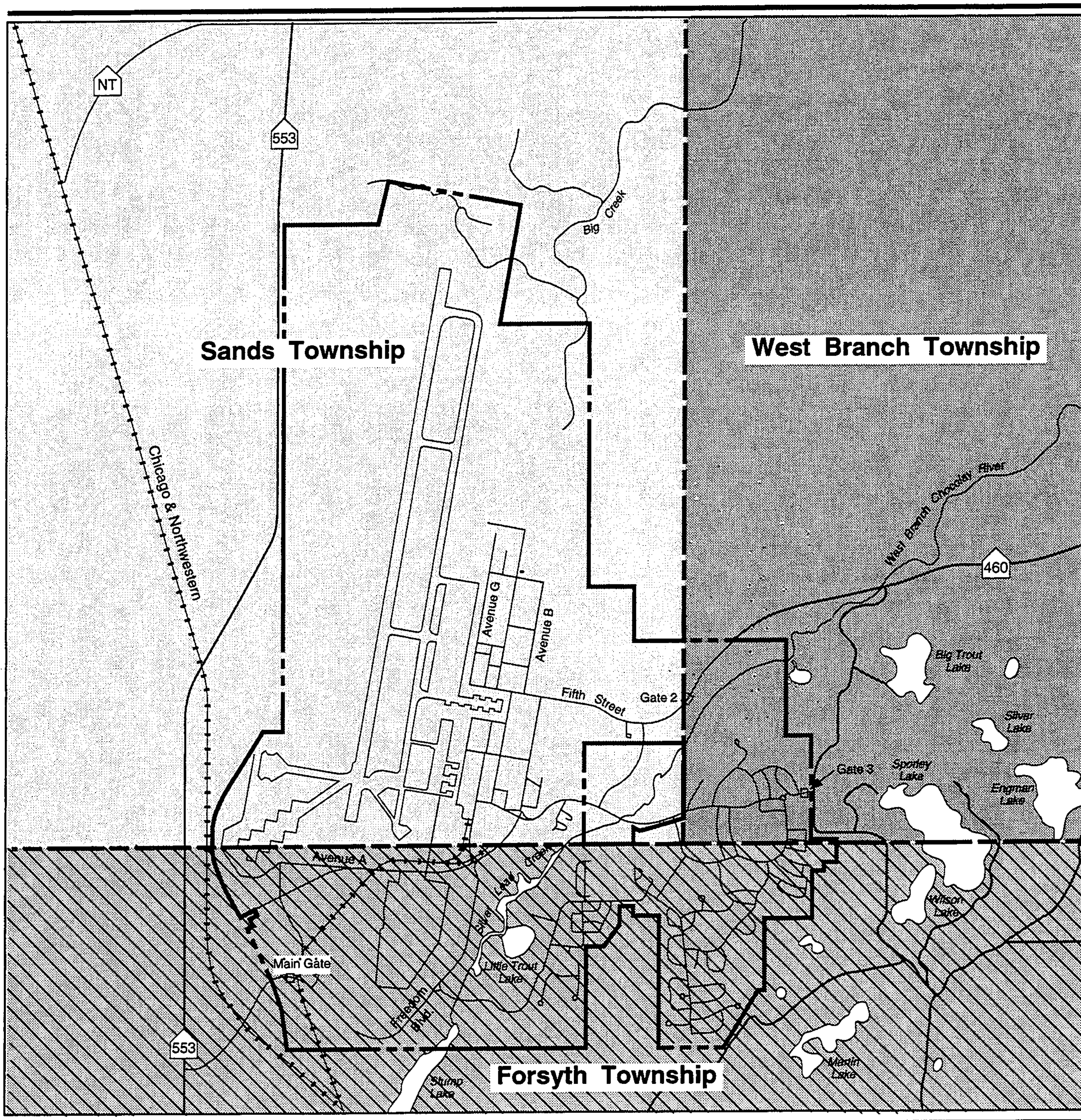
3.2.2.1 Land Use

Land Use Plans and Regulations. The comprehensive plan for a jurisdiction represents the official position on long-range development and resource management. The position is expressed in goals, policies, plans, and actions regarding the physical, social, and economic environments, both now and in the long term.

Of the three townships within the base ROI, only Forsyth and West Branch have comprehensive plans. Since Sands Township does not have a comprehensive plan, the Marquette County Comprehensive Plan (revised February 1991) serves as the planning guideline. The county comprehensive plan advocates concentrated development and consideration of Air Installation Compatible Use Zone (AICUZ) noise and safety policies for development in the vicinity of the base.

The Forsyth Township Comprehensive Plan (1976) policies support the maintenance of open space outside of the Gwinn urban corridor along SH 35, which is 2 miles south of the base. Development within the aircraft noise contours associated with K. I. Sawyer AFB is discouraged.

The West Branch Township Comprehensive Plan (1990) identifies resource production land uses for the areas northeast of the base. Residential development within the base aircraft noise contours is discouraged. The areas east of the base surrounding Big Trout, Engman, and Sporley lakes, which are outside the noise contours, are identified for seasonal and rural residential development.



EXPLANATION

Sands Township

Forsyth Township

West Branch Township

Base Boundary

Township Boundary

553 County Road

0 950 1900 3800 Feet

Jurisdictions

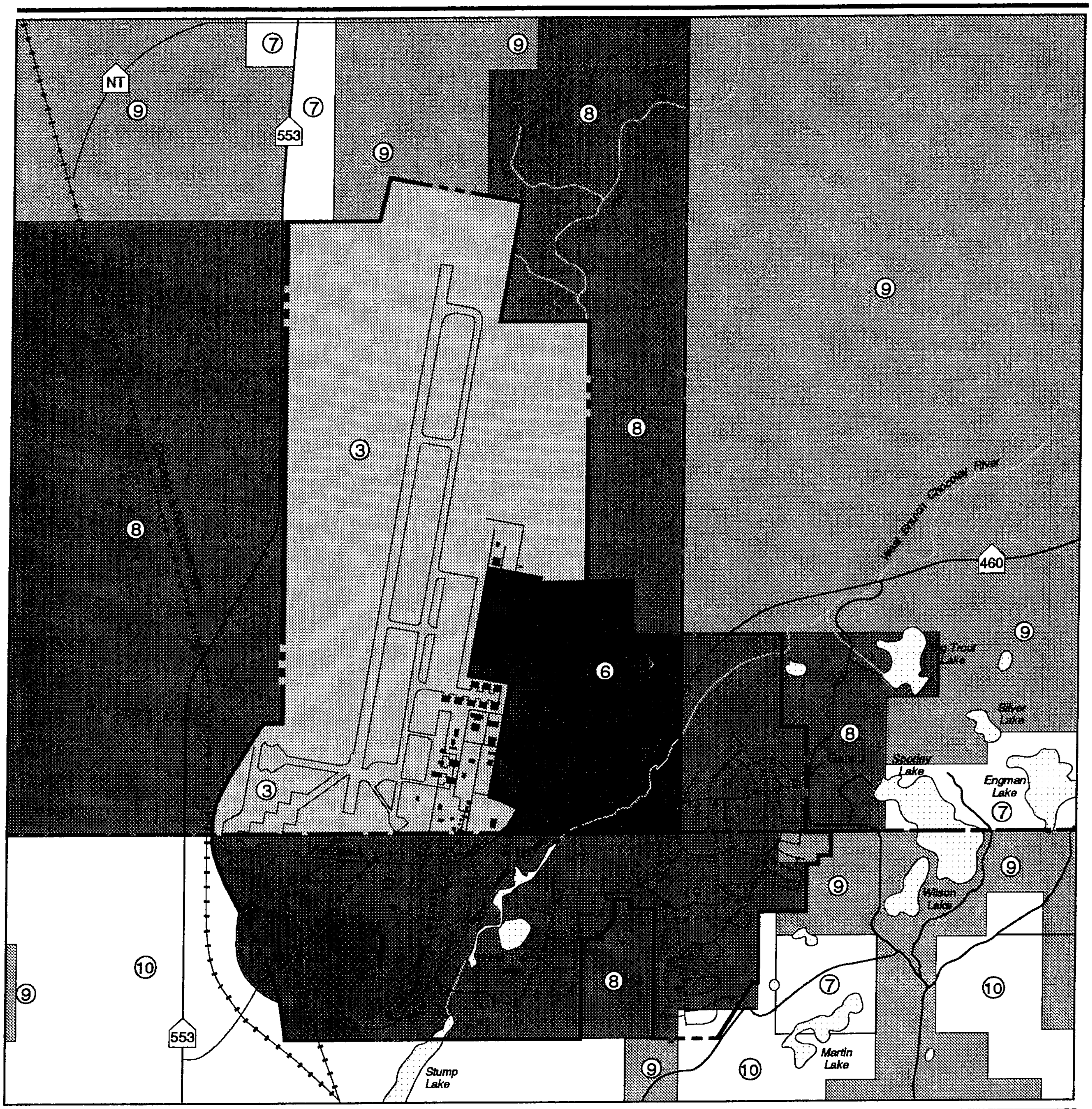
Figure 3.2-3

Zoning. Zoning is the division of jurisdictions into districts within which permissible uses are prescribed and restrictions on building height, density, layout, and other requirements are defined. Zoning is designated to achieve various community development goals, including implementation of comprehensive plans. K. I. Sawyer AFB property falls within the zoning jurisdictions of the Sands, Forsyth, and West Branch townships (Figure 3.2-4).

After the announcement of base closure, Sands Township rezoned the base property within its jurisdiction from public uses, which reflected the military use of the base, to categories that anticipate civilian reuse of the property. Sands Township is also in the process of amending the 1973 zoning ordinance. The draft zoning ordinance is expected to be adopted prior to base closure in September 1995. The draft zoning ordinance is intended to ensure that the civilian reuse of the base is consistent with the zoning categories. As rezoned, most of the base property within Sands Township has been identified for industrial uses (see Figure 3.2-4). The industrial zoning allows, through special approval or special use permit, for an airport, higher education institutions, warehousing, manufacturing, experimental laboratories, research and development, fuel storage, and other similar uses. This area, as rezoned, includes the airfield and its associated taxiways and aprons, and flightline facilities. Immediately to the east, in the central portion of the base, the area is zoned for general commercial uses, which allow diversified businesses, such as professional offices, retail, and service establishments. This commercial zoning also allows recreation facilities, light manufacturing, and institutional uses by special approval or special use permit. The area surrounding the golf course, hospital, and WWTP is zoned for restricted commercial uses, such as professional offices, retail, and service establishments, which allows institutional and public facilities/ recreation uses by special approval or special use permit.

The southern portion of the base in Forsyth Township is predominantly zoned for public uses (governmental) with two small parcels zoned for agriculture and open space. In the West Branch Township Interim Zoning Ordinance (1993), the base property has been zoned for public uses. Air Force policy within local zoning designations is typically not enforced because of federal jurisdiction. However, if the base property were conveyed to private ownership, the local zoning designations would be applicable.

Off-base zoning designations within Sands Township north and west of the base are predominantly for recreation and forestry uses. Land along CR 553 north of the base is zoned for single-family residential and agricultural uses, with areas west of the base zoned for public facilities/recreation. The privately owned parcel west of the military family housing area is zoned for restricted commercial uses. Most of the land immediately to the south and west of the base is zoned for open space under the Forsyth Township



EXPLANATION

① Airfield *	⑤ Institutional (Educational) *	⑨ Agriculture
② Aviation Support *	⑥ Commercial	⑩ Open Space
③ Industrial	⑦ Residential	---- Base Boundary
④ Institutional (Medical) *	⑧ Public Facilities/ Recreation	— — — Township Boundary

0 950 1900 3800 Feet

* Standard land use designation not applicable to this figure.

Local Zoning

Figure 3.2-4

Zoning Ordinance (1990). Seasonal dwellings are allowed in the open space zoning with a conditional use permit. Areas adjacent to the southeast and east base boundary are zoned for timber management and limited residential uses. The area east of the base in West Branch Township is zoned predominantly for agricultural uses; this zoning category allows recreation activities and large lot (greater than 5 acres), single-family dwellings. The area surrounding Sporley and Engman lakes, east of the base, is zoned for residential uses, allowing single-family and mobile homes, and recreational uses on 20,000-square-foot or larger lots. The area surrounding Big Trout Lake is zoned for recreational use, which allows seasonal resorts and lodges by conditional use permit. No permanent residences are allowed under this zoning.

On-Base Land Use. Present on-base land use is described by nine land use categories shown in Figure 3.2-5. A privately owned tract is adjacent to the family housing area.

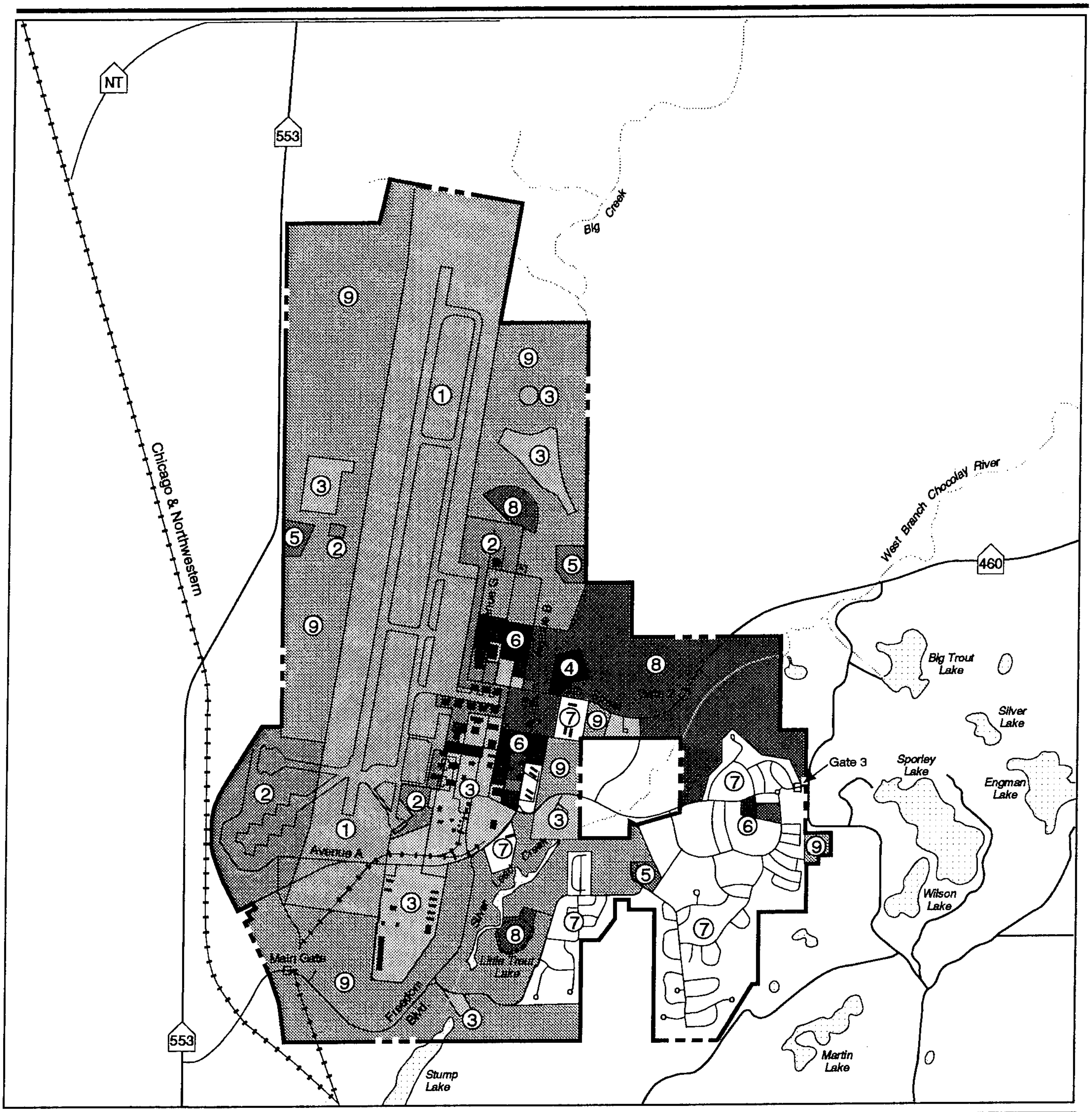
The base property, totaling 4,923 acres, includes the following existing land uses and acreages:

Land Use	Acreage
Airfield	1,195
Aviation support	315
Industrial	378
Institutional (medical)	17
Institutional (educational)	43
Commercial	72
Residential	647
Public facilities/recreation	518
Agriculture (forest)	1,738
Total	4,923

The **airfield** land use bisects the base from north to south and includes the 12,300-foot runway, primary taxiway, operational apron, power check pad, and the associated approach zones at both ends of the runway.

The **aviation support** land use areas contain the aircraft alert apron, ATC tower, fire station, maintenance hangars, and readiness crew training facility. Most of the aviation support facilities are along the east side of the airfield, with the exception of the alert apron, transmitter, and readiness crew facility.

The **industrial** areas are separated into three general areas. The first is in the south-central portion of the base, and includes the base supply warehousing,



EXPLANATION

- ① Airfield
- ② Aviation Support
- ③ Industrial
- ④ Institutional (Medical)
- ⑤ Institutional (Educational)
- ⑥ Commercial
- ⑦ Residential
- ⑧ Public Facilities/ Recreation
- ⑨ Agriculture (Forest)
- - - - - Base Boundary

0 950 1900 3800 Feet

Existing On-Base Land Use

Figure 3.2-5

civil engineering complex, shop areas, security police kennels, fuel storage/management, vehicle maintenance areas, WWTP, and Weapons Storage Area. The second area is the explosive ordnance disposal (EOD) range and former landfill in the northeast quadrant of the base, east of the airfield. The third industrial area is the grenade range on the west side of the airfield.

Institutional land uses are separated into two categories: medical and educational. The medical land use consists of the base hospital adjacent to the golf course. Educational land use occurs in five areas on base: (1) the education center in the central portion of the base, (2) the flight simulator in the central portion of the base, (3) a security police obstacle course northwest of the golf course, (4) a training area west of the airfield, and (5) the K. I. Sawyer Elementary School, adjacent to the military family housing area, in the southeastern portion of the base.

The main **commercial** land use areas are located throughout the central part of the base and include the Base Exchange and Commissary shops, and administrative office buildings associated with headquarters and operations. Other commercial land uses include the military family housing support office and a service station/convenience store in the military family housing area.

There are four **residential** areas on K. I. Sawyer AFB. Three of these areas are centrally located and include the Airmen's, Noncommissioned Officers' (NCO), and Officers' dormitory complexes. The dormitory complexes can accommodate up to 844 persons. The fourth area includes military family housing in the southeastern part of the base. This area includes permanent housing for 1,653 families and temporary housing for up to 35 families in buildings that range from single-family to eight-unit townhouses. In addition, the housing area has two mobile home parks containing 200 spaces for privately owned mobile homes.

Public facilities/recreation land uses include the indoor recreation buildings such as the bowling center and gymnasium, and outdoor recreation facilities such as the golf course, designated skiing and hiking areas, skeet range, ball fields, and the picnic area adjacent to Little Trout Lake. The chapel, Child Care Center, and Youth Center within the military family housing area are within this land use designation.

The **agriculture (forest)** lands consist of undeveloped areas throughout the base, which are used for timber production, recreation, and/or safety buffers.

Leases and Easements. The Air Force typically outgrants real estate and facilities to other agencies and private individuals for use of the base property. At K. I. Sawyer AFB, the branch banking facility is leased to First

National Bank. Other major outgrants are to Michigan Bell Telephone Company, K. I. Sawyer AFB Housing, Forsyth School District, and the Alger-Marquette Community Action Board (Table 3.2-2).

In addition, the Air Force holds ingrants with agencies and private individuals to use property outside the base boundaries. These are primarily avigation and right-of-way easements (Table 3.2-3). Major base avigation easements include approximately 239 acres at the north end of the runway. In addition, there are approximately 52 acres of road, railroad, and sanitary sewer easements. Ingrants also include property leased from DOI and the state of Michigan.

Adjacent Land Use. K. I. Sawyer AFB is located on the Upper Peninsula of Michigan and is surrounded by the Escanaba River State Forest, except for a privately owned area northeast of the base (Figure 3.2-6). The forest includes both public (county and state) and private land adjacent to the base in Sands, Forsyth, and portions of West Branch townships. Forested, county-owned land east, west, and south of the base is utilized for timber production and recreation uses. East of the base, an elementary school is located adjacent to the military family housing area. In addition, several seasonal dwellings are adjacent to lakes east of the base. Land uses north of the base consist of rural single-family homes, a mobile home park, and a church. The private property that is surrounded by the base is in the southeast portion, west of the military family housing area, and is forested and bisected by two road rights-of-way.

Air Force Policies Affecting Adjacent Land Uses. The Air Force has developed the AICUZ program to minimize development that is incompatible with aviation operations in areas on and adjacent to military airfields. The AICUZ land use recommendations are based on (1) land uses compatible with exposure to aircraft noise and (2) safety considerations. Recommended compatible land uses are derived from data on noise contours (Noise Zones) and safety zones (Accident Potential Zones [APZs]). Noise Zones and APZs are delineated specifically for each base, using operational information derived from the base mission. Municipalities with jurisdiction over adjacent lands may zone this land in accordance with AICUZ recommendations, but they are not required to do so. An AICUZ report for K. I. Sawyer AFB was issued in 1978 and revised in 1993 (U.S. Air Force, 1993a). The comprehensive plans for West Branch and Forsyth townships and Marquette County (representing Sands Township) all incorporate AICUZ policies.

AICUZ noise contours are based on standard noise ratings that are calculated from types of aircraft, number of daily aircraft operations, time of day flown, aircraft flight patterns, power settings, air speeds, altitudes, and climatic conditions. A day-night weighted average sound level (DNL) is used to describe the noise environment. Noise contours for preclosure conditions at K. I. Sawyer AFB are presented and discussed in Section 3.4.4.

Table 3.2-2. Inventory of Easement Agreements, Licenses, Permits, and Leases in Effect, October 1993 (Outgrants)

Document Number	Expiration Date	Description	Responsible Party
KIS-1-89-0001	August 14, 1994	Remote telephone equipment	Michigan Bell Telephone Company
KIS-1-90-0002	October 6, 1995	Bus shelter	Marquette County Transit
KIS-1-91-0001	January 31, 1996	Office space	K. I. Sawyer AFB
KIS-1-91-0002	August 9, 1996	Automated Teller Machine next to shoppette	First National Bank
KIS-3-87-0001[(a)]	September 30, 1994	Building 745 and Shooting Range	Sawyer Sportsman Club
AF 20(613)-10	April 27, 2013	Armed Services Housing	K. I. Sawyer Housing, Inc.
AF 20(613)-11	April 27, 2013	Armed Services Housing	K. I. Sawyer Housing #2, Inc.
AF 20(613)-18	October 24, 2015	Armed Services Housing	K. I. Sawyer Housing #8, Inc.
AF 20(613)-183	October 24, 2015	Armed Services Housing	K. I. Sawyer Housing #10, Inc.
AF 20(613)-26	September 1, 2013	Armed Services Housing	K. I. Sawyer Housing #3, Inc.
AF 20(613)-27	September 1, 2013	Armed Services Housing	K. I. Sawyer Housing #4, Inc.
AF 20(613)-391	August 7, 2016	Armed Services Housing	K. I. Sawyer Housing #11, Inc.
AF 20(613)-65	July 27, 2014	Armed Services Housing	K. I. Sawyer Housing #5, Inc.
AF 20(613)-66	July 27, 2014	Armed Services Housing	K. I. Sawyer Housing #6, Inc.
AF 20(613)-67	July 27, 2014	Armed Services Housing	K. I. Sawyer Housing #7, Inc.
AF 20(613)-182	October 24, 2015	Armed Services Housing	K. I. Sawyer Housing #9, Inc.
DA20064ENG4238	February 29, 2012	K. I. Sawyer Elementary School	Forsyth School District
DACA-45-1-75-6052	October 31, 1994	Joint Military Services Credit Union	Joint Military Services Credit Union
DACA-45-1-77-6087	August 19, 1995	Office space for Union	National Federation of Federal Employees Local 1256
DACA-45-1-79-6245	April 30, 2004	Bank	First National Bank
DACA-45-3-76-6112[(a)]	September 30, 1995	Instrument cable to trailer	Michigan Bell Telephone Company
DACA-45-3-84-6143[(a)]	September 30, 1996	Telephone line	Michigan Bell Telephone Company
DACA-45-4 81-6101	January 31, 1995	Defense fuels supply point	Escanaba Fuels Supply Point
Not given	Not given	Headstart program use of Buildings 209-211	Alger-Marquette Community Action Board
Not given	Not given	Portion of Building 726	K. I. Sawyer Base Conversion Authority

Note: (a) Lease has not been finalized.

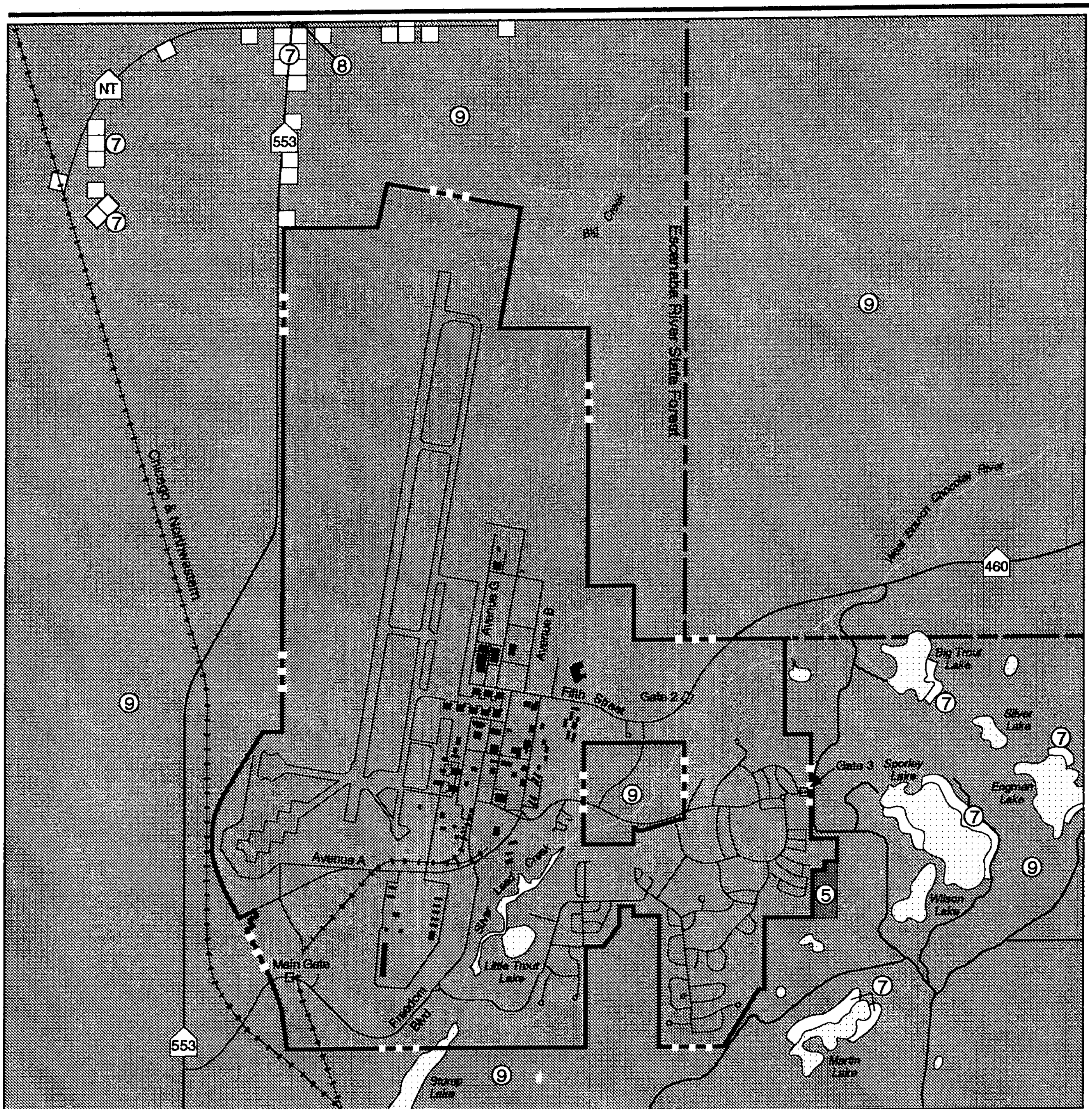
Table 3.2-3. Inventory of Easement Agreements, Licenses, Permits, and Leases in Effect, October 1993 (Ingrants)

Document Number	Expiration Date	Description	Responsible Party
KIS-4-88-0001	January 1, 1995	Commander's Land Mobile Radio system	National Weather Service
KIS-5-90-0002	September 30, 1995	Antenna tower in Ishpeming	Michigan National Guard
KIS-9-90-0001	September 23, 1995	Right of Entry for environmental testing	Beico, Inc.
COE80-38-005-3	December 31, 1995	Emergency storage	Department of the Army
DA20064ENG4238	June 30, 2054	Use as Air Force Base	State of Michigan
DACA-45-5-92-00142	August 31, 1995	Commander's land mobile radio	Goetz Communications Corporation
KIS-9-92-0003	May 18, 1997	Purge well near Avenue BB	Beico, Inc.
KIS-9-91-0001	October 9, 1996	Right of entry to private property	Marquette County
Not given	Perpetual	291 acres avigational and right-of-way easements (Tab D 5-1)	Various property owners
Not given	Perpetual	160 acres public domain (Tab D 5-1)	Department of the Interior
Not given	Not given	Lease of space on an antenna tower that is owned by Northern Michigan University, on top of a building owned by Marquette Housing Authority	Northern Michigan University, Marquette Housing Authority
Not given	Not given	Groundwater extraction well	Beico, Inc.

According to the 1993 AICUZ report, a total of 27,089 acres of land were exposed to aircraft noise levels of DNL 65 decibels (dB) and above, and off-base land uses within this contour include predominantly forested and open space lands, with some industrial, commercial, residential, and public facilities/recreation uses.

The AICUZ delineates areas at both ends of the runway where the probability of aircraft accidents is highest, based on the locations of past aircraft accidents at various locations. The risk of accidents is so high in the areas at the immediate ends of the runway (known as the Clear Zones) that the Air Force has a program to acquire easements to preclude most land uses. At K. I. Sawyer AFB, both Clear Zones are entirely within base property (Figure 3.2-7). The Clear Zone at the north end of the runway includes airfield and agricultural (forest) land uses. The Clear Zone at the south end of the runway includes airfield, aviation support, and industrial land uses, and overlies two storage igloos, a weapon shop, and the readiness crew facility.

Certain land use restrictions are recommended in lower risk areas, identified as APZ I and APZ II. Industrial, agricultural, recreation, and vacant land uses



EXPLANATION

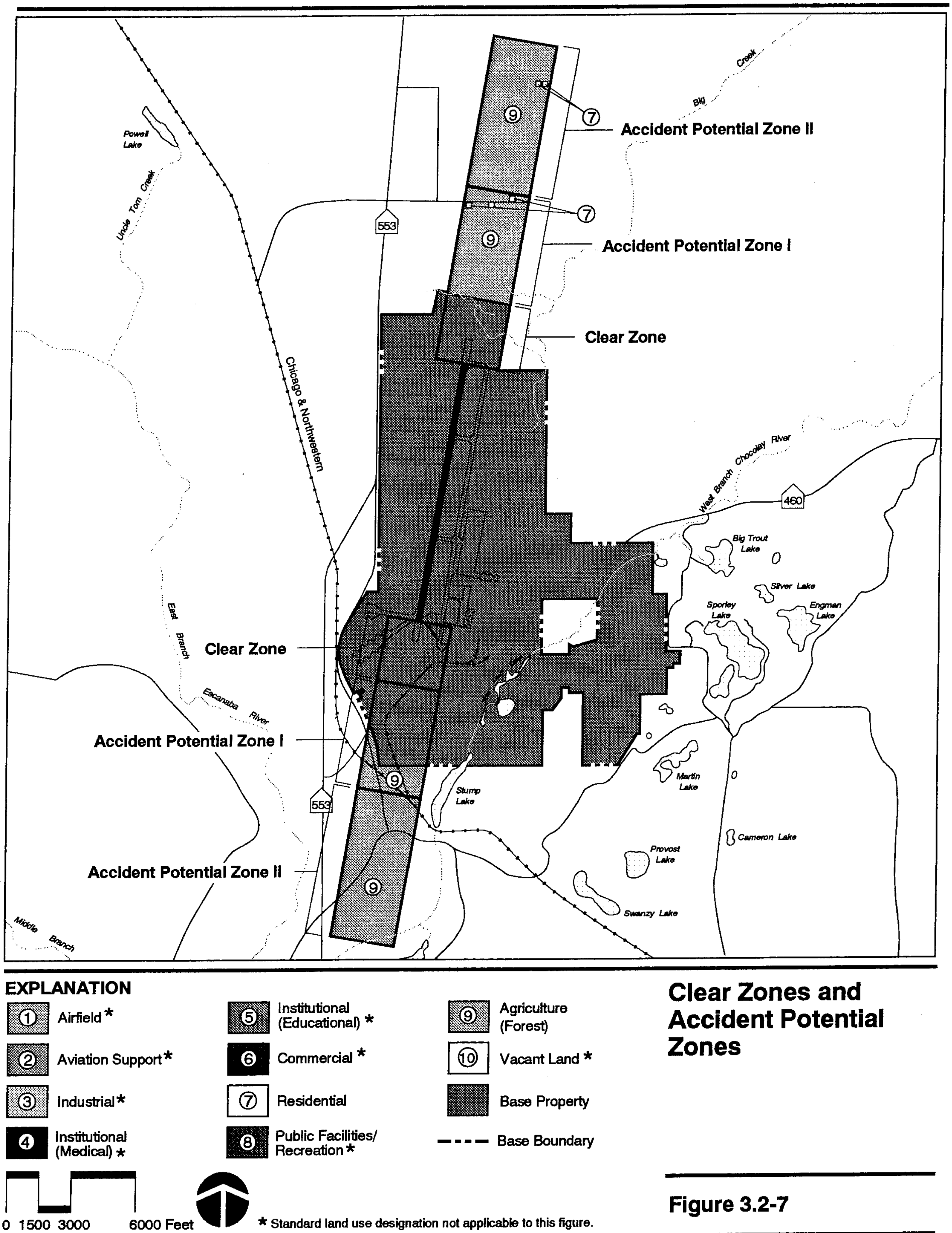
- ① Airfield *
- ② Aviation Support *
- ③ Industrial *
- ④ Institutional (Medical) *
- ⑤ Institutional (Educational)
- ⑥ Commercial *
- ⑦ Residential
- ⑧ Public Facilities/ Recreation
- ⑨ Agriculture (Forest)
- ⑩ Vacant Land *
- Base Property
- Escanaba River State Forest
- Base Boundary

0 950 1900 3800 Feet

* Standard land use designation not applicable to this figure.

Existing Off-Base Land Use

Figure 3.2-6



Clear Zones and Accident Potential Zones

Figure 3.2-7

are compatible with APZ I, but all residential uses and land uses with a high concentration of people, such as commercial and institutional, are discouraged. At K. I. Sawyer AFB, the APZ I at the south end of the airfield encompasses both on-base and off-base property, overlying a portion of the Weapons Storage Area and primarily undeveloped forested land. The APZ I at the north end of the runway overlies forested land and three single-family residences.

The Air Force identifies APZ II as having a lower accident potential than APZ I, allowing low-density residential (a maximum of two units per acre) and nonresidential uses (maximum of 20 percent building coverage per acre), in addition to those uses listed for APZ I. The APZ IIs at K. I. Sawyer AFB encompass mostly forested land, with two single-family residences located within the northern APZ II.

The AICUZ program applies only to military airfields. Similar criteria are established by the FAA for civilian airports. After the closure of K. I. Sawyer AFB, FAA criteria will apply if the airport converts to civilian activities.

Closure Baseline. In September 1995, the installation was closed and the military activities on base was terminated. The OL will continue to coordinate the disposal activities of the base property, serve as the U.S. Air Force liaison supporting community reuse, and establish a caretaker force to assure resource protection, grounds maintenance, utility operations, and building care for base facilities.

3.2.2.2 Aesthetics. Visual resources include natural and man-made features that give a particular environment its aesthetic qualities. Criteria used in the analysis of these resources include visual sensitivity, which is the degree of public interest in a visual resource and concern over adverse changes in its quality. Visual sensitivity is categorized in terms of high, medium, or low levels.

High visual sensitivity exists in areas where views are rare, unique, or in other ways special, such as in remote or pristine environments. High visual sensitivity views would include landscapes that have landforms, vegetative patterns, water bodies, or rock formations of unusual or outstanding quality.

Medium visual sensitivity areas are more developed than those of high sensitivity, and the presence of motorized vehicles and other evidence of modern civilization is commonplace. These landscapes generally have features containing varieties in form, line, color, and texture, but tend to be more common than high visual sensitivity areas.

Low visual sensitivity areas tend to have minimal landscape features, with little change in form, line, color, and texture.

Opened in 1955, K. I. Sawyer AFB is one of the newer Air Force bases in the United States. Since the mid-1980s, there has been an active program to maintain and update base facilities. Consequently, most of the facilities are in good condition. Generally, the base structures have a standard architectural character, with little variation.

The area surrounding K. I. Sawyer AFB is characterized by forested, rolling hills and numerous streams, wetlands, and lakes. Vegetation in the area is mainly mixed forests, including redpine and jackpine. Poorly drained areas include American larch, black spruce, and aspen. The changes in the topography and vegetation contribute to distinct areas of differing visual sensitivity.

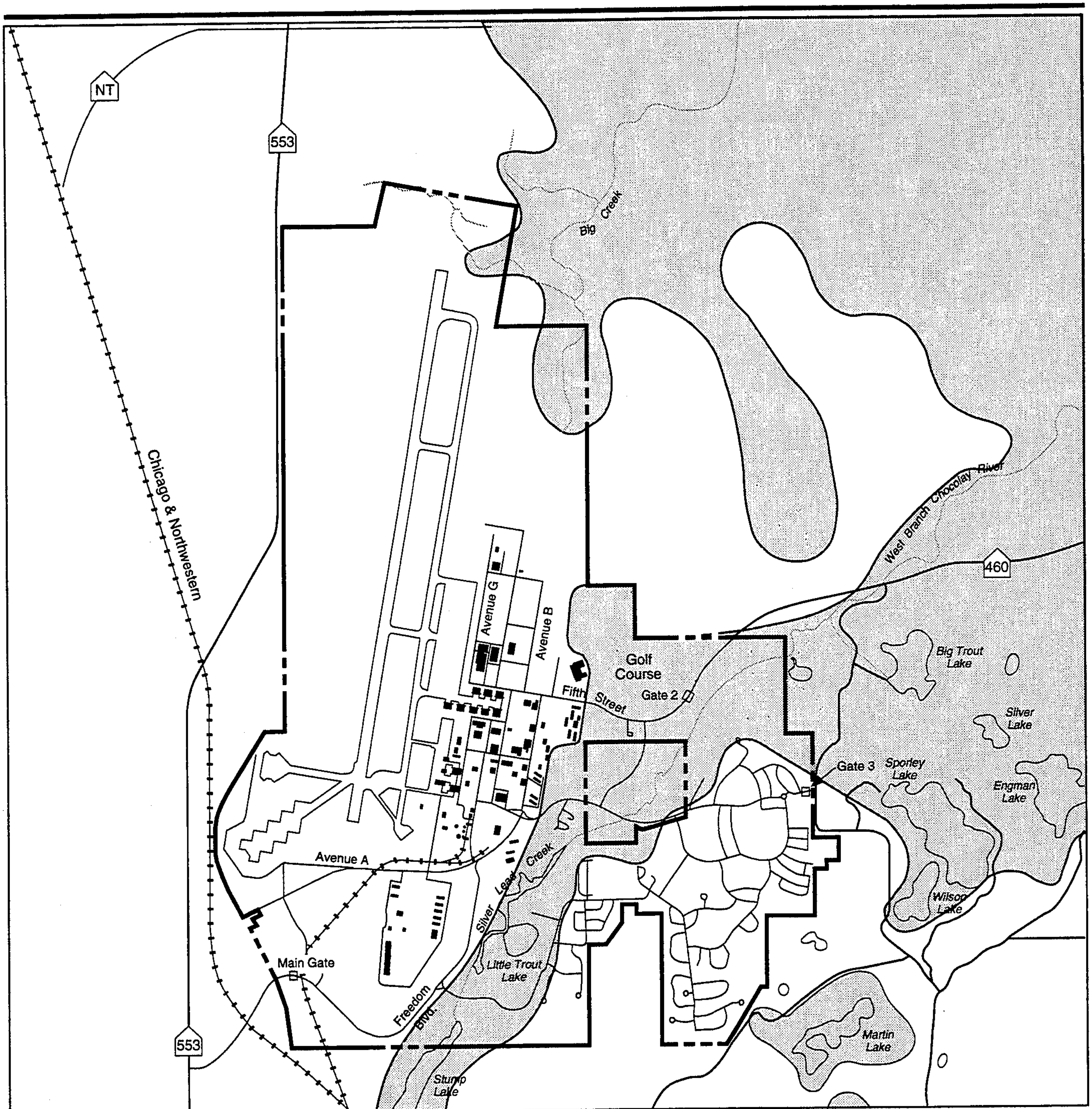
On base, areas of high visual sensitivity include the Silver Lead Creek, Little Trout Lake, Stump Lake riparian area, and the golf course (Figure 3.2-8). The developed or cleared portions of the base generally exhibit medium and low visual sensitivity. High visual sensitivity areas off base include the region surrounding the West Branch of the Chocolay River, and around Big Trout, Silver, Engman, Sporley, Wilson, and Martin lakes, and Big Creek.

3.2.3 Transportation

Transportation addresses roadways, airspace and air transportation/air traffic, and other modes of transportation. The ROI for the transportation analysis includes the existing principal road, air, rail, and waterway networks in the local communities of Marquette, Gwinn, Skandia, and Little Lake, with emphasis on the immediate area surrounding K. I. Sawyer AFB.

3.2.3.1 Roadways. The evaluation of the existing roadway conditions focuses on capacity, which reflects the ability of the network to serve the traffic demand and volume. Capacity is stated in terms of vehicles per hour (VPH), and is the maximum number of vehicles that can be effectively processed by a segment of roadway or intersection during 1 hour. Roadway capacity is a function of several factors including the number of lanes, lane and shoulder width, traffic control devices (e.g., traffic signals), and percent trucks. For two-lane roads, capacity analysis is conducted for both directions; for multilane highways, capacity analysis considers a single direction only.

To determine how well a section of roadway operates, capacity is compared to the volume of traffic carried by the section. These traffic volumes may be distinguished as (1) average annual daily traffic (AADT), the total two-way volume averaged for a full year; (2) average daily traffic (ADT), the total two-way traffic averaged for a period of time less than 1 year; and (3) peak-hour volume (PHV), the amount of traffic that occurs in the typical peak hour. True AADTs can only be estimated by counting traffic continuously throughout the year on a section of roadway, a practice which is done for



EXPLANATION

High Sensitivity

Base Boundary

0 950 1900 3800 Feet

Visual Sensitivity

Figure 3.2-8

only 50 to 100 sites in a typical state due to equipment costs. However, ADTs from counts of shorter duration (e.g., 24 to 48 hours) are much more plentiful. These ADTs are factored using data available from the continuous-count sites to develop estimates of AADT for each short-count site. AADT estimates in this section were developed by applying factors to short counts (ADTs), since no continuous-count locations are within the study area.

An assessment of PHVs and roadway capacity is conducted to establish the Level of Service (LOS) during the peak hour. The LOS scale ranges from A to F, with each level defined by a range of volume-to-capacity ratios. LOS values of A, B, and C are considered good operating conditions where minor or tolerable delays are experienced by motorists. LOS D and E represent acceptable but below average conditions. LOS F represents an unacceptable situation of unstable stop-and-go traffic. Table 3.2-4 presents the LOS designations and their representative volume-to-capacity ratios for the typical two-lane highway found in the study area. These levels are more fully described in the Highway Capacity Manual (Transportation Research Board, 1985).

Table 3.2-4. Road Transportation Levels of Service

LOS	Description	Criteria (Volume/Capacity) Two-Lane Highway
A	Free flow with users unaffected by presence of other users of roadway	0-0.10
B	Stable flow, but presence of the users in traffic stream becomes noticeable	0.11-0.23
C	Stable flow, but operation of single users becomes affected by interactions with others in traffic stream	0.24-0.39
D	High density, but stable flow; speed and freedom of movement are severely restricted; poor level of comfort and convenience	0.40-0.57
E	Unstable flow; operating conditions at capacity with reduced speeds, maneuvering difficulty, and extremely poor levels of comfort and convenience	0.58-0.94
F	Forced breakdown flow with traffic demand exceeding capacity; unstable stop-and-go traffic	Greater than 0.94

LOS = Level of Service

Source: Compiled from Transportation Research Board, 1985.

Existing roads and highways within the ROI are described at three levels: (1) regional, representing the major links within the Marquette area; (2) local, representing community roads; and (3) on-base roads.

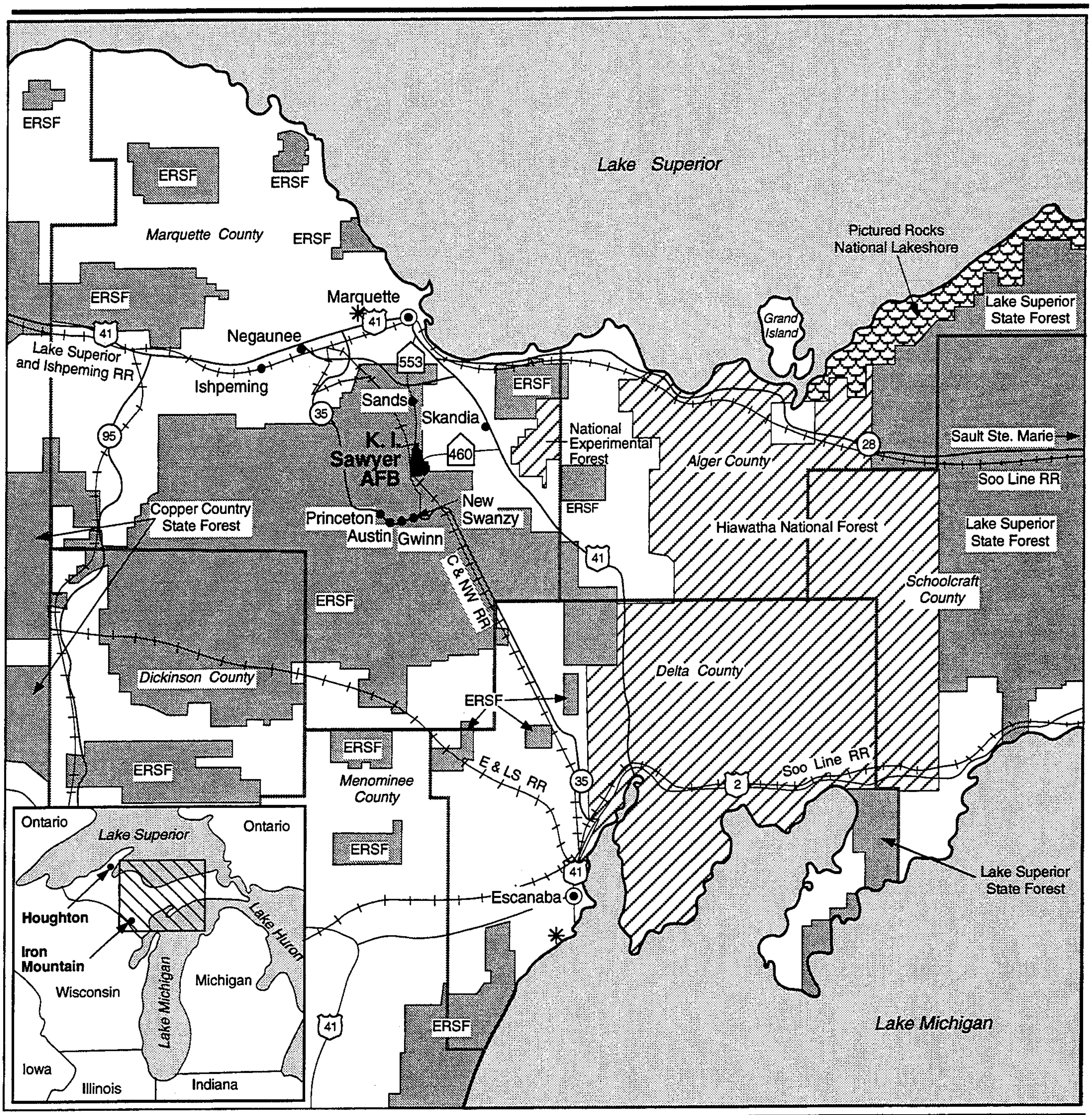
Regional. The region surrounding K. I. Sawyer AFB is served by a network of state and county highways (Figure 3.2-9). Marquette, Michigan, 20 miles north of the base, is the major population center in this region. SH 28 is the main two-lane east-west highway providing regional access between Sault Ste. Marie, Michigan, 140 miles to the east, and Marquette. U.S. 41, a two-lane north-south highway, connects Marquette to Escanaba, Michigan, 55 miles to the south. SH 35, a local two-lane north-south highway, connects the community of Gwinn, just south of the base, to Negaunee and Escanaba.

Local. Figure 3.2-10 identifies the general local road network in the immediate vicinity of K. I. Sawyer AFB at the time of base closure. CR 553, a two-lane undivided highway with a speed limit of 55 miles per hour, connects SH 35 in Gwinn to the city of Marquette. The AADT on CR 553, just north and south of the base, is 6,300. CR 480, a two-lane undivided highway, connects U.S. 41 to CR 553 just south of Marquette and 10 miles north of the base. Other key roads in the ROI include CR 456, which connects SH 35 and the community of Little Lake to U.S. 41, and CR 545, a north-south road just east of the base, which connects CR 460 to CR 456. Both of these are two-lane undivided highways.

On-Base. Figure 3.2-11 shows the locations of the gates that provide access to K. I. Sawyer AFB and the on-base street network. Access to K. I. Sawyer AFB is provided by three gates. The Main Gate (Gate 1) is accessed from CR 462, which intersects CR 553 approximately 0.5 mile west of the gate. Gate counts show an AADT traffic volume of 5,580 at this location. Gate 2, with an AADT of 1,840, is accessed from CR 460, which connects to U.S. 41 south of the community of Skandia (see Figure 3.2-10). Gate 3, which serves the military family housing area, is seldom used and access is from Sporley Lake Road. The Main Gate and Gate 2 are open 24 hours, and Gate 3 is open from 6:30 a.m. to 12:30 a.m.

Key on-base roads that lead to the gates are Freedom Boulevard (Main Gate) and Fifth Street (Gate 2).

Preclosure Reference. Capacity analyses were conducted on the surrounding roadways. The preclosure (1992) PHVs, capacities, and LOS on key community roadways are shown in Table 3.2-5. All of the roadways in the ROI experience an LOS of C or better. The segment with the most congestion is CR 553, south of Marquette. This section, together with CR 480 west of CR 553, carries most of the heavy truck volume. These trucks haul iron ore from the mines west of Marquette to the harbor and return with crushed limestone. Trucks southbound from Marquette on CR 553 travel uphill grades, and this section has been approved for the addition of a truck lane in 1995.



EXPLANATION

- ✳ Airport
- (41) U.S. Highway
- (35) State Highway
- (553) County Road
- National Forest
- State Forest

ERSF Escanaba River State Forest

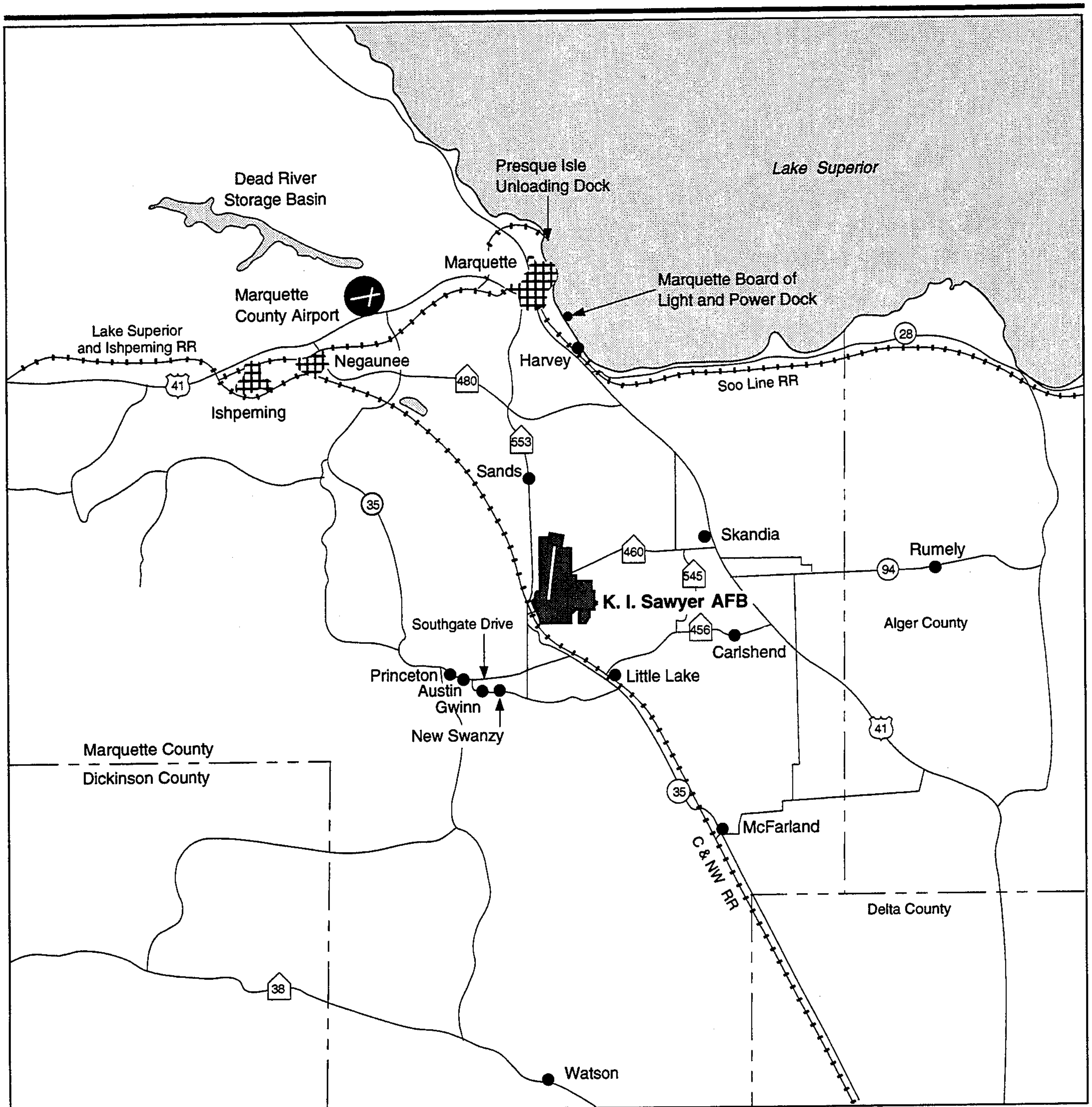
E & LS Escanaba and Lake Superior

C & NW Chicago and Northwestern

0 3.5 7 14 Miles

Regional Transportation System

Figure 3.2-9



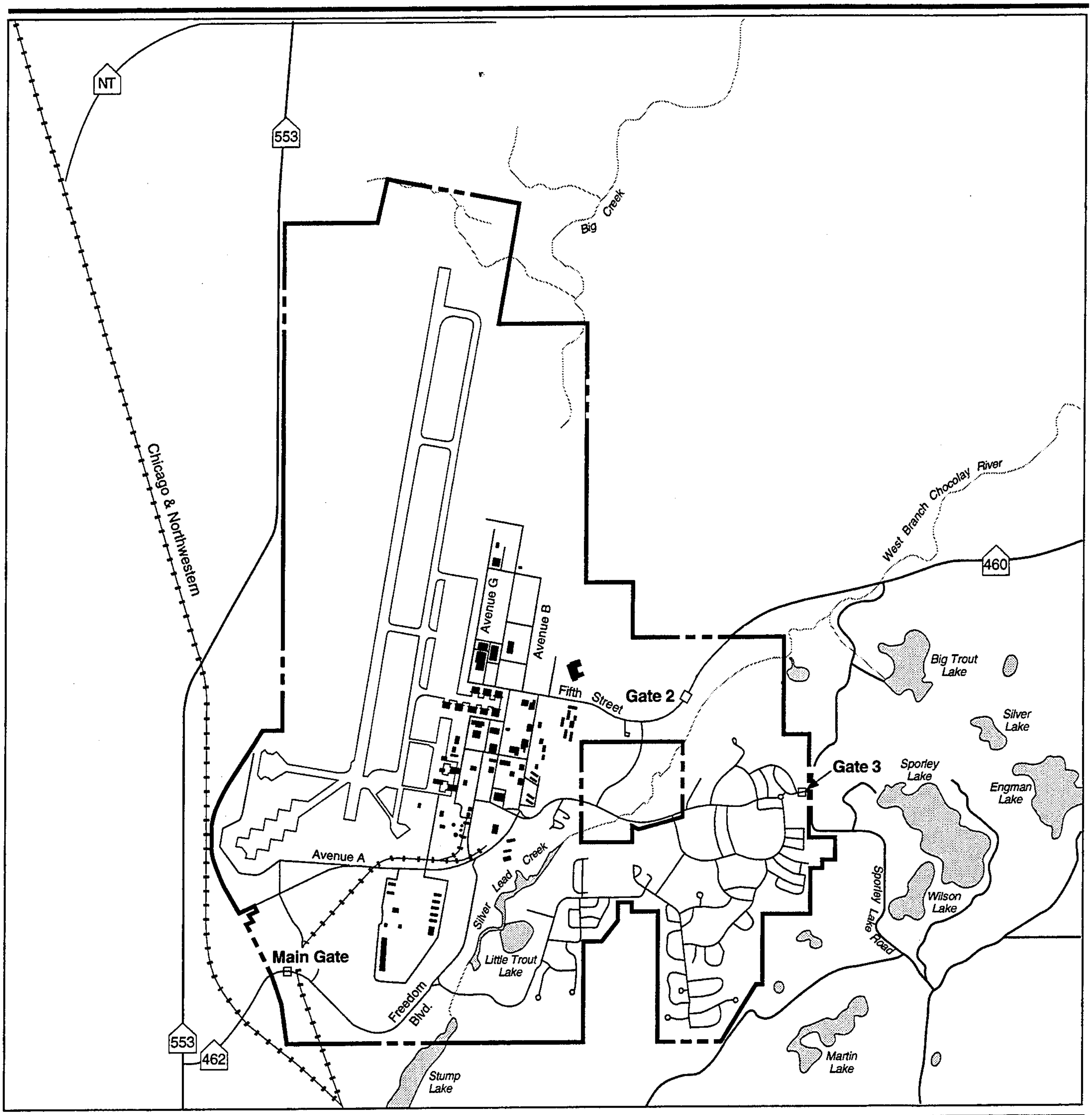
EXPLANATION

41	U.S. Highway		Public Use Airport
35	State Highway		County Line
553	County Road	C & NW	Chicago and Northwestern

0 2 4 8 Miles

Local Transportation System

Figure 3.2-10



EXPLANATION

Base Boundary

553 County Road

Key On-Base Roads

0 950 1900 3800 Feet

Figure 3.2-11

Table 3.2-5. Peak-Hour Traffic Volumes and LOS

Roadway	Segment	Preclosure (1992) Capacity[a] (PHV)	Preclosure (1992) Traffic[a] (PHV)	Preclosure (1992) LOS	Closure (1995) Traffic[a] (PHV)	Closure (1995) LOS
Local						
CR 462	Main Gate to CR 553	2,050	650	C	40	A
CR 460	Gate 2 to CR 545	2,050	200	B	10	A
CR 460	CR 545 to U.S. 41	2,050	160	A	150	A
CR 480	West of CR 553	1,750	440	C	350	B
CR 480	CR 553 to U.S. 41	2,050	280	B	300	B
CR 553	Marquette city limits to CR 480	2,050	645	C	450	B
CR 553	CR 480 to CR 462	2,050	670	C	400	B
CR 553	CR 462 to Southgate Drive	2,050	730	C	400	B
CR 553	Southgate Drive to SH 35	2,050	420	B	300	B
CR 545	U.S. 41 to CR 460	1,700	100	A	100	A
CR 545	CR 460 to CR 456	1,700	25	A	50	A
CR 456	SH 35 to CR 545	1,700	195	B	150	A
CR 456	CR 545 to U.S. 41	1,700	60	A	50	A
Regional						
U.S. 41	SH 28 to Skandia	2,050	710	C	700	C
U.S. 41	Skandia to SH 94	2,050	470	C	450	B
U.S. 41	SH 94 to CR 456	2,050	250	B	250	B
SH 35	CR 553 to CR 456	2,050	280	B	150	A
SH 35	CR 456 to Morbit Lake Access	2,050	80	A	100	A

Notes: Rolling terrain, 20 percent no passing, 60-40 directional split, and peak hour factor of 0.9 used in all capacity calculations.
(a) For two-lane highways, PHV and capacity are two-way.
CR = County Road
LOS = Level of Service
PHV = peak-hour volume
SH = State Highway
U.S.# = U.S. Highway

Closure Baseline. Upon closure of K. I. Sawyer AFB (September 1995), traffic in the vicinity of the base will decrease. Traffic generated by the base will be associated with the OL and caretaker, with the Main Gate and Gate 2 being the only access points. Table 3.2-5 shows the projected closure PHV and LOS for the key roadways in the ROI. The LOS of all roadways would either remain the same or would improve from preclosure to closure. Based on population projections and discussions with the Marquette County Highway Department, a growth factor of 1 percent per year was assumed for the years prior to closure.

3.2.3.2 Airspace/Air Traffic. Airspace is a finite resource that can be defined vertically and horizontally, as well as temporally, when describing its use for aviation purposes. As such, it must be managed and utilized in a manner that best serves the competing needs of commercial, general, and military aviation interests. The FAA is responsible for the overall management of airspace and has established different airspace designations that are designed to protect aircraft while operating to or from an airport, transitioning en route between airports, or operating within "special use" areas identified for defense-related purposes. Rules of flight and ATC procedures have been established that govern how aircraft must operate within each type of designated airspace. All aircraft operate under either instrument flight rules (IFR) or VFR.

The type and dimension of individual airspace areas established within a given region and their spatial and procedural relationships to one another are contingent upon the different aviation activities conducted in that region. When any significant change is planned for this region (such as airport expansion, a new military flight mission, etc.), the FAA will reassess the airspace configuration to determine if such changes will adversely affect (1) ATC systems and/or facilities, (2) movement of other air traffic in the area, or (3) airspace already designated and used for other purposes (i.e., restricted areas).

The ROI selected for this airspace analysis is an area within a 20-nautical mile (nm) radius of K. I. Sawyer AFB from the surface up to 12,000 feet above MSL. The ROI encompasses the different airspace areas that are associated with normal operations at K. I. Sawyer AFB. Airspace within and immediately surrounding this ROI is under the jurisdiction of the Minneapolis Air Route Traffic Control Center (ARTCC), which is operated by the FAA. In the vicinity of K. I. Sawyer AFB, the base RAPCON has been delegated the responsibility of providing approach and departure control to all IFR aircraft. Aircraft operations at other airfields within the ROI, as well as flyover traffic, are managed by ATC airspace operating procedures in order to minimize potential airspace conflicts with traffic from K. I. Sawyer AFB. Airspace above 12,000 feet MSL in the ROI is controlled by Minneapolis ARTCC and is not affected by operations from K. I. Sawyer AFB.

Preclosure Reference. An understanding of the ROI airspace/air traffic environment and its use under the preclosure reference is necessary to help determine its capability and capacity to assimilate future aviation activities into the National Airspace System. The same constraints and considerations, such as terrain, runway alignments, and other air traffic flows, would apply under alternate aviation uses of K. I. Sawyer AFB.

Airspace designated for ATC purposes around K. I. Sawyer AFB consists of low-altitude federal airways (Victor Airways), military training routes (MTRs), transition areas, control zones, and military operations areas (MOAs).

Figure 3.2-12 depicts each of the designated ATC airspace areas in the K. I. Sawyer AFB ROI. Navigational aids at K. I. Sawyer AFB include a very high-frequency omnidirectional range tactical air navigation (VORTAC) system and approach surveillance radar. Although the navigational aids are generally well maintained and in good condition, most of the equipment is not compatible with FAA standards.

The K. I. Sawyer AFB RAPCON controls airspace that is delegated to the base by Minneapolis ARTCC. K. I. Sawyer AFB provides ATC services to arriving and departing aircraft, as well as aircraft practicing approaches, for K. I. Sawyer AFB and the private airports of Bonnie, Johnson, and Lesterson.

The traffic patterns, instrument approaches, and departure procedures used at K. I. Sawyer AFB under preclosure conditions represent the airspace requirements for IFR aircraft operating at the base and transitioning between the base and the en route airspace system. In 1992, a total of 87,235 operations were conducted by both transient and based aircraft at K. I. Sawyer AFB (Table 3.2-6).

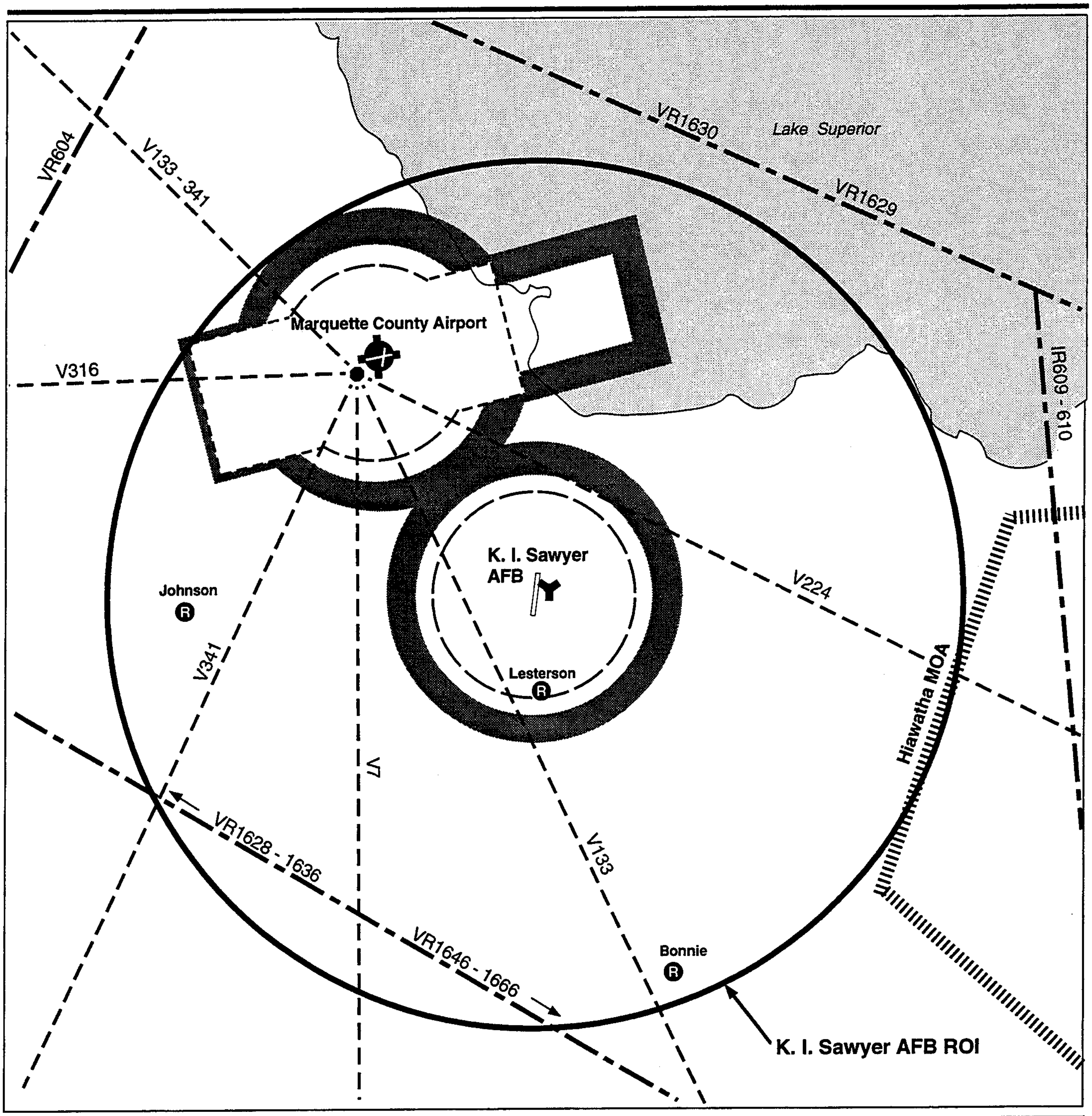
Table 3.2-6. K. I. Sawyer AFB Aircraft Operations, 1992

	Aircraft Operations			
Assignment	Type	Day	Night	Total
Aircraft based at K. I. Sawyer AFB	B-52H	28,908	3,212	32,120
	KC-135A	13,140	1,460	14,600
	T-37B	36,135	4,015	40,150
Transients		328	37	365
Total		78,511	8,724	87,235

Note: An aircraft operation is one takeoff or one landing.

The orderly flow of the base IFR aircraft is predicated on the use of instrument procedures and traffic patterns or other directions from ATC to maintain proper sequencing and separation. Primary published IFR arrival and departure flight paths for K. I. Sawyer AFB are shown on Figures 3.2-13 and 3.2-14, respectively.

Defense-related airspace within the 20-nm ROI includes a VFR MTR (VR 1628-1636/VR 1646-1666), which consists of a northwest/southeast route passing to the south of K. I. Sawyer AFB. These routes are used by DOD and associated Air Force Reserve and Air National Guard units for low-altitude navigation and tactical training in VFR weather conditions at altitudes below 10,000 feet above MSL and at airspeeds in excess of 250 knots. In addition to the VFR MTR routes, the Hiawatha MOA located



EXPLANATION

Public Use Airport

Restricted/Private Use Airport

Control Zone

Transitional Airspace

Very High Frequency Omnidirectional Range Tactical (VORTAC) Air Navigation System

Very High Frequency Omnidirectional Range-Distance Measuring Equipment

Military Operations Area (MOA)

Federal Airway

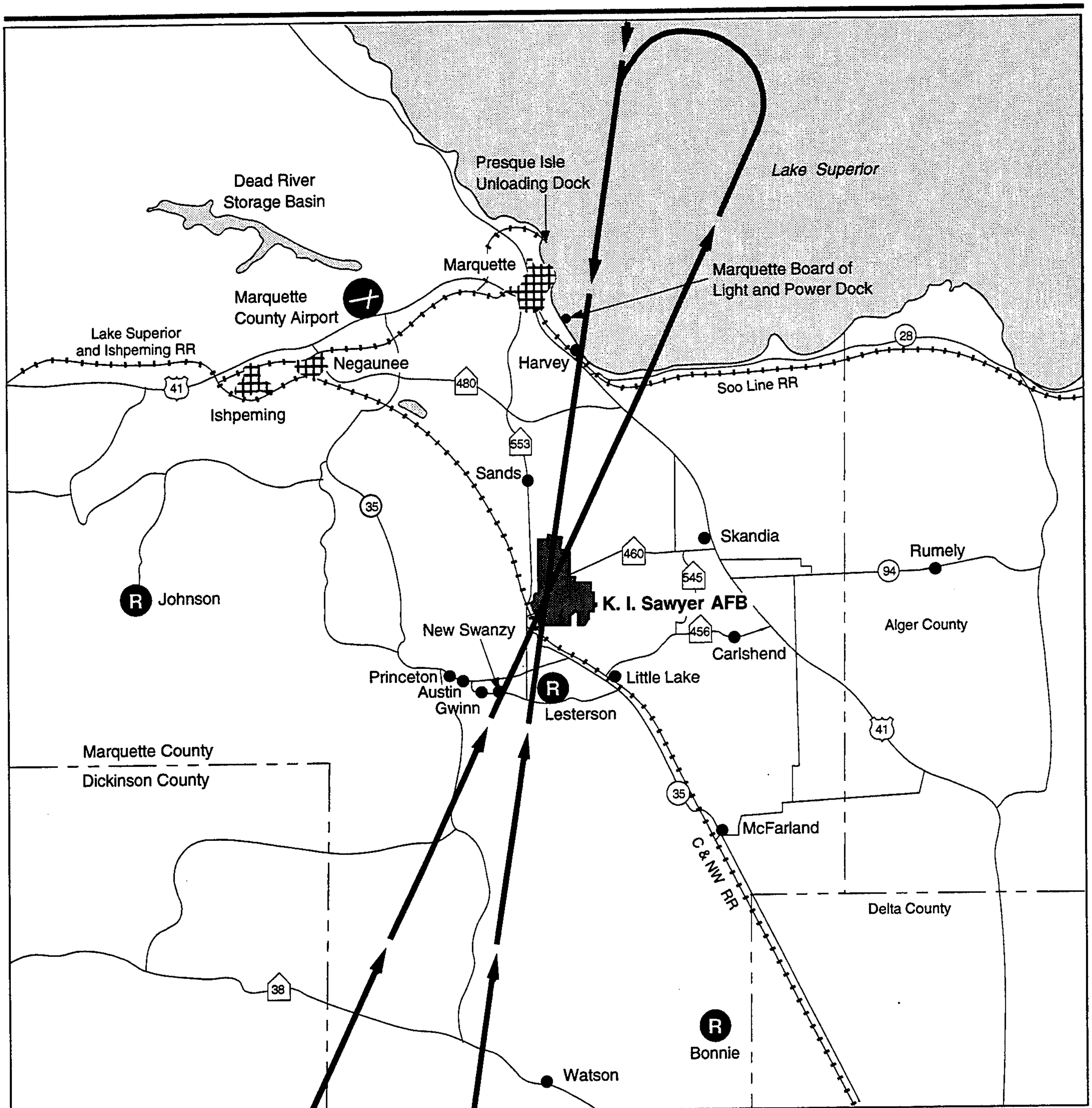
Region of Influence (ROI)

Military Training Route

0 1.75 3.5 7 Nautical Miles

Airspace Region of Influence

Figure 3.2-12



EXPLANATION

Flight Paths for K. I. Sawyer AFB

41 U.S. Highway

35 State Highway

38 County Road

R Restricted/Private Use Airport

Public Use Airport

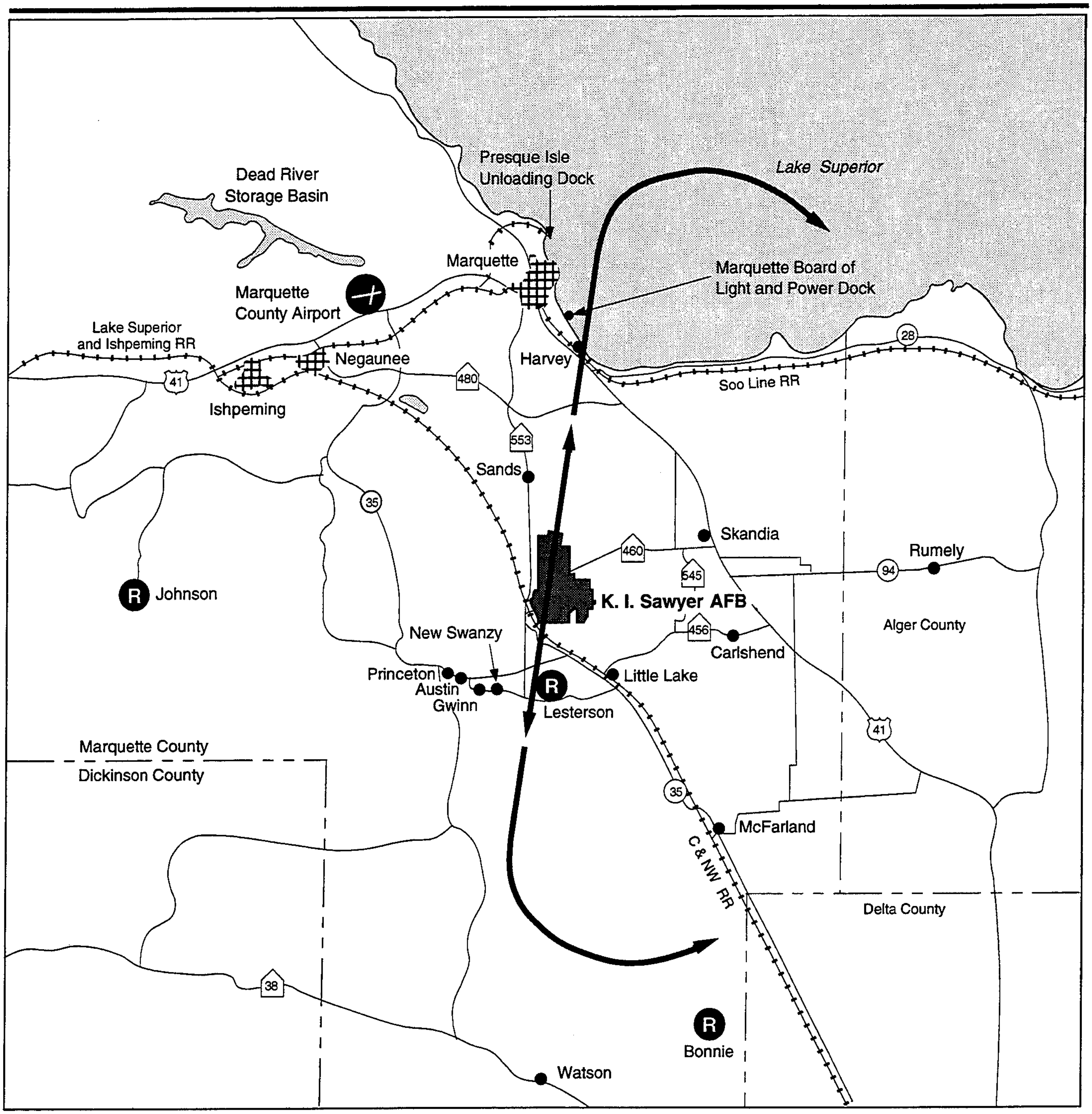
County Line

C & NW Chicago and Northwestern

0 2 4 8 Miles

Primary IFR Arriving Aircraft Flight Paths

Figure 3.2-13



EXPLANATION

Flight Paths for K. I. Sawyer AFB

U.S. Highway

State Highway

County Road

Restricted/Private Use Airport

Public Use Airport

County Line

C & NW Chicago and Northwestern

0 2 4 8 Miles

Primary IFR Departing Aircraft Flight Paths

Figure 3.2-14

20 nm east of the base is predominantly utilized by K. I. Sawyer AFB aircraft for training activities.

Of the four airports within the ROI, only Marquette County Airport is public. The other three (Bonnie, Johnson, and Lesterson) are restricted-use, grass-strip, private airports, and aircraft operations occur only during VFR weather conditions. Marquette County Airport has ILS runway approach procedures. Marquette County Airport consists of a 6,500-foot runway, and commercial service is provided by three air carriers. Aircraft operating at the four airports are generally unaffected by flight operations at K. I. Sawyer AFB. Aircraft within the ROI generally contact K. I. Sawyer AFB approach control when approaching an area airport or transitioning through the base airspace. Activity levels at Marquette County Airport for 1992 and 1995 are illustrated in Table 3.2-7.

Table 3.2-7. Projected Aircraft Operations for Civil Public-Use Airports in the Vicinity of K. I. Sawyer AFB

	Annual Operations	
Airport	1992	1995[a]
Marquette County		
Commercial operations	9,000	10,600
General aviation operations	25,000	27,100
Total	34,000	37,700

Note: (a) Projected annual operations from Airport Master Plan.
Source: Greiner, Inc., 1991.

Closure Baseline. Upon termination of flight operations at K. I. Sawyer AFB, all designated ATC airspace areas and published instrument procedures would be canceled and the areas would revert to the control of the Minneapolis ARTCC. The RAPCON, ATC, and navigational aids at K. I. Sawyer AFB could be removed from operational service pending reuse requirements for these facilities. It is not likely that the airspace ROI would be used by Minneapolis ARTCC for new IFR or VFR transit routes because removal of the K. I. Sawyer AFB RAPCON would eliminate radar coverage in the vicinity of the base. VFR aircraft operating from the surrounding public and private airports could transit freely throughout the airspace surrounding the base without any tower communication requirements or concerns with military aircraft operations. In addition, the closure of K. I. Sawyer AFB would eliminate the need for the Hiawatha MOA; therefore, this restricted airspace area could be removed from the FAA airspace control system.

3.2.3.3 Air Transportation. Air transportation includes passenger travel by commercial airline and charter flights, business and recreational travel by

private (general) aviation, and priority package and freight delivery by commercial and air carriers.

Marquette County Airport provides scheduled passenger service for the ROI. Airports in Iron Mountain (approximately 70 miles southwest of Marquette), Escanaba (Delta County Airport), and Hancock/Houghton Airport (see Figure 3.2-9) also provide passenger service to the western Upper Peninsula; however, the number of passengers from the ROI using these airports is very small. In 1992, Marquette County Airport recorded approximately 40,000 passengers boarded. There is no scheduled air cargo service at Marquette County Airport.

Marquette County Airport will experience a decrease in passenger traffic after closure of K. I. Sawyer AFB, primarily because of the loss of base-related traffic. This decrease should not affect the air carriers that service the region.

3.2.3.4 Other Transportation Modes. The Chicago and Northwestern railroad provides freight service to K. I. Sawyer AFB via a rail spur. The tracks are seldom used, but are maintained and are in good condition.

Marquette Harbor is the major port in the ROI for exporting iron ore and importing coal and limestone. According to the 1992 Harbor Master Dock Report, the Presque Isle unloading dock in the upper harbor is the only dock that exports iron ore. In 1992, 287 vessels exported 7,497,842 tons of ore. This dock also served 54 vessels importing 1,424,441 tons of coal and 12 vessels importing 264,936 tons of limestone. The limestone is used in the local iron ore mines to produce iron pellets. The dock at the city of Marquette Board of Light and Power imported 123,382 tons of coal and 330,655 tons of limestone on 23 vessels. Marquette Harbor would not be affected by base closure.

3.2.4 Utilities

The utility systems addressed in this analysis include the facilities and infrastructure used for:

- Potable water pumping, treatment, storage, and distribution
- Wastewater collection and treatment
- Solid waste collection and disposal
- Energy generation and distribution, including the provision of electricity and natural gas.

The ROI for utilities is made up of the service areas of each utility provider servicing the base and local community. The major attributes of utility systems in the ROI are processing, distribution, and storage capacities and related factors, such as average daily consumption and peak demand, required in making a determination of adequacy of such systems to provide services in the future.

Projected utility use at the time of closure (1995) was developed based on discussions with the purveyors, historic consumption patterns, and systemwide average annual growth rates. All projections were adjusted to reflect the decrease in demand associated with the base closure and are presented in Table 3.2-8.

Table 3.2-8. Estimated Utility Demand in the ROI

	Preclosure 1992	1993	1994	Closure 1995
Water consumption (MGD)[a]	4.07	4.15	3.9	2.79
Wastewater treatment (MGD)[a]	4.45	4.44	4.19	3.13
Solid waste (tons/day)	148.11	139.04	135.34	124.95
Electrical consumption (MWH/day)	1,148	1,129	1,105	939.5
Natural gas consumption (MMCF/day)	10.31	10.14	9.68	8.44

Note: (a) These figures do not account for farm residences or commercial/industrial activities outside town or city limits.
MGD = million gallons per day
MMCF = million cubic feet
MWH = megawatt-hours

3.2.4.1 Water Supply. The ROI for water supply consists of K. I. Sawyer AFB and the areas served by the city of Marquette and Forsyth Township. The combined capacity of these service areas can produce 11.3 MGD of water. West Branch and Sands township residents obtain water from private wells.

On-Base. K. I. Sawyer AFB obtains water for domestic and industrial uses from four on-base wells with a combined capacity of 3 MGD. Water is stored on base in four storage facilities: a large underground reservoir (approximately 500,000 gallons), an in-ground tank of 15,000 gallons, and two 200,000-gallon elevated towers. Total storage capacity of these facilities is 915,000 gallons. Average daily consumption in 1992 was approximately 1.0 MGD. The golf course is irrigated with water from Silver Lead Creek. However, plans are under way to connect the golf course sprinkler system to the main water system.

Off-Base. The city of Marquette obtains its water from Lake Superior and its average daily consumption was 2.67 MGD in 1992, with a pumping capacity of 9 MGD. The city is planning construction of a 7-MGD filtration plant by 1998. Forsyth Township operates five wells, and in 1992 supplied an estimated 0.40 MGD to the residents of Gwinn, Austin, Princeton, and New Swanzy. The system has a 1.3-MGD capacity and 250,000 gallons of storage. Residents located outside the urban areas rely on private wells for water.

Preclosure Reference. Average daily potable water consumption in the ROI is presented in Table 3.2-8. The average daily water use for the base has been 25 percent of the potable water consumed in the ROI.

Closure Baseline. Potable water consumption in the ROI is projected to be 2.79 MGD by 1995. Water consumption at K. I. Sawyer AFB will decrease as the drawdown of personnel occurs from 1993 to closure. Demand from continuing operations of the OL and caretaker will be approximately 0.02 MGD, or less than 1 percent of the ROI.

3.2.4.2 Wastewater. The ROI for wastewater treatment consists of K. I. Sawyer AFB and the areas served by the city of Marquette and Forsyth Township. The combined system capacity in these service areas can treat up to 8.4 MGD. West Branch and Sands townships use private septic systems to process their wastewater flows.

On-Base. Wastewater generated on K. I. Sawyer AFB is collected and processed by the 2.5-MGD capacity tertiary treatment plant on base. Average daily flows of 0.9 MGD are discharged to the Silver Lead Creek under a National Pollutant Discharge Elimination System (NPDES) permit from the state of Michigan. Industrial wastes are pretreated in an aeration lagoon prior to mixing with the base's domestic wastewater and treatment in the plant. Septic systems provide backup service to six lift stations and also to the Main Gate facility. Sludge from the treatment process is pumped through a two-stage gravity-thickening system and disposed of on forest lands.

Off-Base. The city of Marquette provides wastewater treatment to residents of the city and portions of Marquette and Chocolay townships (east of Marquette Township). The city's WWTP has a capacity of 5.5 MGD and had average daily flows of 3.17 MGD in 1992. In 1994, the city stopped processing leachate from the county landfill. The city found that the biological oxygen demand from leachate was consuming the remaining organic loading capacity at the plant (see Section 3.2.4.3). Forsyth Township operates a three-cell lagoon with a design capacity of 0.4 MGD, and treats wastewater from approximately 1,000 customers and two schools. Residents located outside the urban areas rely on septic systems to treat domestic wastewater.

Preclosure Reference. Table 3.2-8 presents wastewater generation in the ROI. In 1992, the on-base flow constituted about 20 percent of the wastewater generated in the ROI.

Closure Baseline. As the drawdown of base personnel proceeds, on-base wastewater flows will decrease to less than 0.01 MGD, or less than 1 percent of the ROI. Wastewater generation in the ROI is projected to be 3.13 MGD.

3.2.4.3 Solid Waste. The ROI for solid waste disposal consists of waste disposal facilities that serve Marquette County.

On-Base. Solid waste generated at K. I. Sawyer AFB is taken off base by a commercial hauler and disposed of in the Marquette County landfill in Sands Township, Michigan. Medical wastes are hauled off base by private contractors.

Off-Base. Solid waste disposal in Marquette County is handled by a 53-acre landfill site in Sands Township operated by the Marquette County Solid Waste Management Authority. Prior to disposal, solid wastes are transported to a processing facility, where various materials are removed for recycling or recovery. Remaining materials are processed by a baler and placed in landfill cells. The landfill has an expected life span of 23 years. A redesign of the landfill is being studied that would add 8 years to its life span. Leachate from the landfill and liquids recovered during the material processing are collected and taken to the K. I. Sawyer AFB WWTP for disposal. The base has a renewable agreement with the county to take the leachate for 6 months.

Preclosure Reference. Table 3.2-8 presents the amount of solid waste disposed of in the ROI. K. I. Sawyer AFB disposed of approximately 17.2 tons per day in 1992. This amount constituted approximately 12 percent of the solid waste disposed of in the ROI.

Closure Baseline. As the drawdown of base personnel proceeds, solid waste generation at closure is estimated at 0.15 ton per day, or less than 1 percent of the ROI. Solid waste disposal in the ROI is estimated to be 124.95 tons per day in 1995.

3.2.4.4 Energy. The ROI for energy consists of the local service areas for the Upper Peninsula Power Company (UPPCO), the Marquette Board of Light and Power, Michigan Gas Company, and Michigan Consolidated Gas Company. UPPCO's service area includes the cities of Ishpeming and Negaunee, Forsyth Township, and the base. The Marquette Board of Light and Power serves the city of Marquette and portions of the county. The Board also provides electricity to Alger Delta Cooperative Electric Association for distribution within the county.

Electricity

On-Base. Electricity is provided to K. I. Sawyer AFB by UPPCO. It is delivered to K. I. Sawyer AFB through one substation with an 11,200-kilovolt-ampere capacity. Peak electrical demand on that substation in 1992 was 9,100 kilowatts.

Off-Base. UPPCO and the city provide electrical power to customers in the Marquette area. UPPCO had electrical sales of 492 MWH/day in 1992 in the Marquette area and sold 2,172 MWH/day to 46,430 customers within its entire service area. The Marquette Board of Light and Power service area had sales of 656 MWH/day.

Preclosure Reference. Table 3.2-8 presents electrical consumption in the ROI. K. I. Sawyer AFB consumed approximately 156.11 MWH/day in fiscal year 1992. This amount constituted approximately 14 percent of the electricity consumed in the ROI.

Closure Baseline. As the drawdown of base personnel proceeds, electrical consumption in the ROI is expected to decrease to an estimated 939.5 MWH/day in 1995. Electrical consumption at K. I. Sawyer AFB from closure operations is estimated to be about 15 MWH/day, or approximately 2 percent of electricity consumed in the ROI.

Natural Gas

On-Base. Natural gas is provided to the base by Michigan Gas Company through a high-pressure gas line entering near the Main Gate. A central heating plant provides high-temperature water to 1.6 million square feet of floor space at K. I. Sawyer AFB. This plant used 177 MMCF of natural gas in 1992, in addition to coal, wood, and fuel oil for heating on-base facilities. In addition to high-temperature water, natural gas is supplied to the base housing units.

Off-Base. Michigan Gas Company, a wholly-owned subsidiary of Southwestern Michigan Gas Enterprises, Inc., serves 13 counties and 89,000 customers in the Upper and Lower peninsulas of Michigan. In the Marquette area the company serves 14,000 customers including the base. The company sold 9.72 MMCF/day of natural gas in 1992. Michigan Consolidated Gas Company provides natural gas to 1,210 customers in Forsyth Township and Gwinn. In 1992, 0.59 MMCF/day of natural gas was consumed in this area.

Preclosure Reference. Table 3.2-8 presents natural gas consumption in the ROI under preclosure conditions. K. I. Sawyer AFB consumed approximately 1.03 MMCF/day in 1992. This amount constituted less than 10 percent of the natural gas consumed in the ROI in 1992.

Closure Baseline. As the drawdown of base personnel proceeds, natural gas consumption in the ROI is expected to decrease to 8.44 MMCF/day. Natural gas consumption at K. I. Sawyer AFB from closure operations is estimated to be about 0.09 MMCF/day, or approximately 1 percent of the amount consumed in the ROI.

3.3 HAZARDOUS MATERIALS AND HAZARDOUS WASTE MANAGEMENT

Hazardous materials and hazardous waste management activities at K. I. Sawyer AFB are governed by specific environmental regulations. For the purpose of the following analysis, the term hazardous waste or hazardous materials will mean those substances defined as hazardous by CERCLA, 42 U.S.C. §§ 9601 et seq., as amended, and the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act (RCRA), 42 U.S.C. §§ 6901-6992, as amended. In general, this includes substances that, because of their quantity, concentration, or physical, chemical, or infectious characteristics, may present substantial danger to public health or welfare or the environment when released into the environment. The state of Michigan defines hazardous substances under Section 3(P) of the Michigan Environmental Response Act (MERA) 307, Michigan compiled laws 299.603(P), which is enforced by the Michigan Department of Natural Resources (MDNR).

Transportation of hazardous materials is regulated by the U.S. DOT regulations within 49 CFR. State regulations regarding transporting hazardous waste are addressed in Part 4 of the Michigan Hazardous Waste Management rules, R299.9401-R299.9412.

Treatment and disposal of nonhazardous waste, including wastewater, is discussed in Section 3.2.4, as part of utilities.

The ROI for hazardous materials and waste encompasses all geographic areas that are exposed to the possibility of a release of a hazardous substance. The ROI for IRP sites is within the existing base boundary, with the exception of groundwater contamination plumes that extend beneath the parcel of private property west of the military family housing area and the plume that extends to off-base property at the north end of the base. Specific geographic areas affected by past and current hazardous waste operations, including remediation activities, are presented in detail below.

The preclosure reference for the purpose of this analysis is December 1992. This date represents conditions of full mission operation prior to initiation of drawdown activities.

3.3.1 Hazardous Materials Management

Preclosure Reference. K. I. Sawyer AFB receives, stores, and utilizes large quantities of hazardous materials. The most commonly utilized hazardous materials include aviation and motor fuels, various grades of petroleum products, lubricants, hydraulic fluids, solvents, paints, thinners, and compressed gases. Hazardous materials are delivered to base supply (Building 727), the heating plant (Building 521), the supply and equipment warehouse (Building 522), the base supply open storage area (Facilities 702 through 705), or the Contract Operated Civil Engineering Supply Systems (COCESS) in Building 421. From these points, the materials are distributed to the workplaces where they are used, with the exception of bulk fuel deliveries (see Section 3.3.4) and solvents for three Safety Kleen cleaning stations, located at the pavements and ground facility (Building 530), auto hobby shop (Building 824), and the vehicle maintenance facility (Building 608).

The base Bioenvironmental Engineer reviews and approves all procurement of hazardous materials utilized on K. I. Sawyer AFB.

The Oil and Hazardous Substances Spill Prevention and Response Plan (U.S. Air Force, 1993e) implemented by the Environmental Management Flight (410 CES/DEV) provides guidance for storage and handling of hazardous substances at K. I. Sawyer AFB. The plan also provides contingency plans identifying key personnel, responsibilities, and facility-specific procedures to follow in the event of a hazardous substance spill.

A repository of Material Safety Data Sheets (MSDSs) for all hazardous materials utilized on base is managed by the base Bioenvironmental Engineer. MSDSs are also available at base supply, and each workplace has an MSDS for each hazardous material utilized or stored at that location.

K. I. Sawyer AFB complies with the Emergency Planning and Community Right-to-Know Act (EPCRA), 42 U.S.C. §§ 11001 et seq., reporting requirements by submitting annual emergency response and extremely hazardous substances updates to the Marquette County Local Emergency Planning Committee. These updates are provided by the Disaster Preparedness Element of the Readiness Flight (410 CES/CEX).

Closure Baseline. At base closure, only the OL and caretaker will be using hazardous materials. All parties will be responsible for managing these materials in accordance with federal, state, and local regulations to protect employees from occupational exposure to hazardous materials, and to protect the public health of the surrounding community. This would include adhering to the EPCRA requirements set forth under the Superfund Amendments and Reauthorization Act (SARA), Title III, of 1986.

The OL and caretaker will be responsible for the safe storage and handling of all hazardous materials used in conjunction with preventive and regular facility maintenance activities, grounds maintenance, and water and wastewater treatment. Hazardous materials may include paint, thinner, solvents, corrosives, ignitables, pesticides, and miscellaneous materials associated with vehicle and machinery maintenance (motor oils/fuels). These materials will be delivered to the base in compliance with the federal Hazardous Materials Transportation Act (HMTA) under 49 CFR.

3.3.2 Hazardous Waste Management

Preclosure Reference. Operations at K. I. Sawyer AFB currently produce wastes defined as hazardous by RCRA (42 U.S.C. § 9601 et seq.), U.S. EPA implementing regulations (40 CFR 261-265), and by the Michigan Administrative Code (R299.9101 to R299.11107), Hazardous Waste Management Rules.

The Environmental Compliance Office oversees the management of hazardous wastes at K. I. Sawyer AFB. The base is currently operating under an RCRA Interim Part B permit. Under this permit, hazardous wastes are transferred to the Defense Reutilization and Marketing Office (DRMO) (Building 417). Hazardous wastes generated on base are collected in drums at satellite accumulation points located at various industrial and flightline facilities (Table 3.3-1). Additionally, 28 waste oil collection points are located throughout the base (Appendix G). These collection points may be an underground storage tank (UST), an oil/water separator, or single 55-gallon drums. The waste oil is picked up and disposed of off base by a contractor. The Plan for Management of Recoverable and Waste Liquid Petroleum (U.S. Air Force, 1990a) was implemented in 1990, and provides guidelines for the collection, storage, recycling, or disposal of recoverable and waste petroleum products generated at K. I. Sawyer AFB that are considered nonhazardous under the Michigan Recycling and Reuse Laws, Michigan compiled laws annotated Chapter 319 §§ 311-316.

Satellite accumulation points can store up to 55 gallons of hazardous waste, or 1 quart of acutely hazardous or extremely hazardous waste for an indefinite period of time. All satellite accumulation points are regularly inspected by the Environmental Management Flight. Upon reaching the criteria limits, wastes are transferred to the DRMO storage facility (Building 417). DRMO utilizes a permitted contractor for disposal of these wastes to a permitted facility off base. Prior to off-base disposal, DRMO personnel inspect and manifest all hazardous waste in accordance with applicable waste management and transportation requirements.

On average, 36,000 pounds of RCRA and non-RCRA wastes were generated by operations at K. I. Sawyer AFB in 1992 and 1993. RCRA wastes are considered hazardous due to their physical and chemical characteristics and

Table 3.3-1. Hazardous Waste Accumulation Points (November 1993)

Building	Number of Sites	Description
Satellite Accumulation Points (up to 55 gallons)		
304	1	Surveillance Inspection Shop
311	1	Surveillance Inspection Shop
321	1	Conventional Munitions Shop
323	1	Missile Assembly Shop
331	3	Missile Assembly Shop
400	1	Weapons Release Shop
402	1	Aircraft Support Storage
404	1	Equipment Calibration Shop
406	1	Fuels Management
408	1	Paint Shop
438	1	Refueling Vehicle Maintenance
441	1	Munitions Trailer Maintenance
530	1	Heavy Equipment Maintenance
608	2	Vehicle Maintenance
609	1	Vehicle Maintenance
627	1	Dock 9 - AGE Shop
663	2	Dock 3 - Tire Shop
664	1	Dock 4 - Aircraft Maintenance
665	5	Dock 5 - Aircraft Maintenance
667	8	Dock 7 - Aircraft Maintenance
725	2	Bomber/Tanker Support
740	2	Engine Shop
824	1	Auto Hobby Shop
850	1	Hospital
Accumulation Point (1-year storage)		
417	1	DRMO

AGE = aerospace ground equipment
DRMO = Defense Reutilization and Marketing Office

their potential to harm humans and the environment. Non-RCRA wastes are defined as wastes excluded from hazardous waste regulation and include recyclable wastes (except for sludge or listed wastes). Non-RCRA waste constituted approximately 6,000 pounds, or 17 percent of all waste generated by the base. In addition, approximately 16,000 pounds of waste oil were generated between 1991 and 1993 and were disposed of as recyclable material under Chapter 319 §§ 311-316.

In an attempt to identify the presence or absence of contamination at RCRA-regulated facilities at K. I. Sawyer AFB, U.S. EPA conducted a Preliminary Review/Visual Site Inspection (PR/VSI) in 1992 and base personnel conducted similar studies in 1993 and 1994. These studies were initiated to identify and collect data on areas of known or potential hazardous substance releases, known as SWMUs and AOCs, and to determine which SWMUs and AOCs pose a threat to human health and the environment. These surveys identified 112 SWMUs and 14 AOCs, at K. I. Sawyer AFB; site descriptions are provided in Appendix G. The need for further investigation and/or remediation actions for these sites is currently being addressed by the U.S. EPA, MDNR, and the base. The inactive lime pits at Buildings 608 (SWMU 80) and 610 (SWMU 57) were remediated in summer 1994. The lime pit at Building 610 is considered a closed site, while SWMU 80 remains open because the results of soil sampling to determine the presence of contamination at Building 608 have not been finalized.

Closure Baseline. At the time of base closure, all of the hazardous waste generated by base functions will have been collected from all designated satellite accumulation points and DRMO and disposed of off site at a permitted facility in accordance with RCRA. Hazardous waste generated by the OL and caretaker will be tracked to ensure proper identification, storage, transportation, and disposal, as well as implementation of waste minimization programs.

The closure of K. I. Sawyer AFB will not affect the remediation and closure activities of SWMUs and AOCs identified during the PR/VSIs. Such activities will continue in accordance with appropriate regulations to protect human health and the environment. Remedial activities could continue past the September 1995 closure date.

3.3.3 Installation Restoration Program Sites

The IRP is an Air Force program to identify, characterize, and remediate past environmental contamination on its installations. Although widely accepted at the time, procedures followed prior to the mid-1970s for managing and disposing of many wastes often resulted in contamination of the environment. The program has established a process to evaluate past disposal sites, control the migration of contaminants, and control potential hazards to human health and the environment. Section 211 of SARA, codified as the Defense Environmental Restoration Program (DERP), of which the Air Force IRP is a subset, ensures that the DOD has the authority to conduct its own environmental restoration programs. The DOD coordinates IRP activities with the U.S. EPA and appropriate state agencies.

Prior to passage of SARA and the establishment of the National Contingency Plan (NCP) for hazardous waste sites, Air Force IRP procedures followed DOD policy guidelines mirroring the U.S. EPA's Superfund program. Since

SARA was passed, many federal facilities have been placed on a federal docket and the U.S. EPA has been evaluating their waste sites for possible inclusion on the National Priorities List (NPL). The U.S. EPA has not proposed K. I. Sawyer AFB for listing on the NPL; however, the base is being reevaluated for possible NPL listing according to the U.S. EPA's revised scoring criteria.

The K. I. Sawyer AFB Restoration Advisory Board (RAB) has been established to provide an avenue for public input to the environmental restoration of the Air Force property to be disposed of. Comments received by the RAB will be addressed by the Base Realignment and Closure (BRAC) Cleanup Team (BCT) and may be incorporated into the BRAC Cleanup Plan. The participants of the BCT include the U.S. EPA, MDNR, K. I. Sawyer Base Conversion Authority members, AFBCA, and local technical consultants. The BRAC Cleanup Plan for the base contains the status, management and response strategy, and action items related to the K. I. Sawyer AFB ongoing environmental restoration and associated compliance programs.

Ongoing activities at identified IRP sites may delay or limit some proposed land uses at or near those sites. Future land uses by the recipients on a site-specific level may be, to a certain extent, limited by the severity of contamination or level of remediation effort at these IRP sites. Reasonably foreseeable land use constraints are discussed in this EIS. Regulatory review as required by the Air Force programs will also ensure that any site-specific land use limitations are identified and considered. A representation of the IRP management process followed by K. I. Sawyer AFB is shown in Figure 3.3-1.

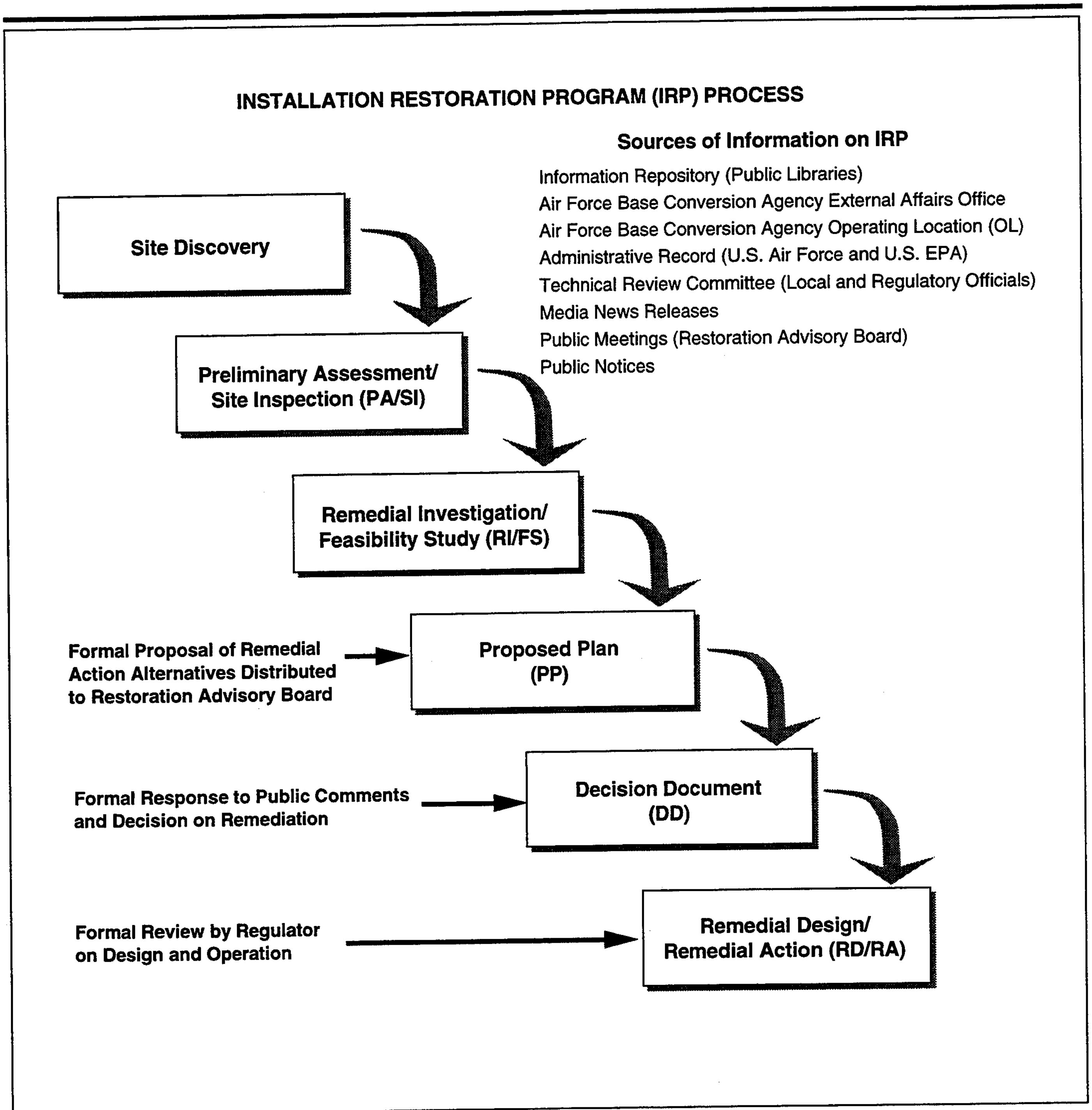
The original IRP was divided into four phases, consistent with CERCLA:

- Phase I: Problem Identification and Records Search
- Phase II: Problem Confirmation and Quantification
- Phase III: Technology Development (TD)
- Phase IV: Corrective Action.

After SARA was passed in 1986, the IRP was realigned to incorporate the terminology used by the U.S. EPA and to integrate the new requirements in the NCP. The result was the creation of three action stages:

- Preliminary Assessment/Site Inspection (PA/SI)
- Remedial Investigation/Feasibility Study (RI/FS)
- Remedial Design/Remedial Action (RD/RA).

The PA portion of the first stage under the NCP is comparable to the original IRP Phase I and consists of a records search and interviews to determine whether potential problems exist. A brief SI that may include soil and water



Pictorial Presentation of IRP Process

Figure 3.3-1

sampling is performed to give an initial characterization or confirm the presence of contamination at a potential site.

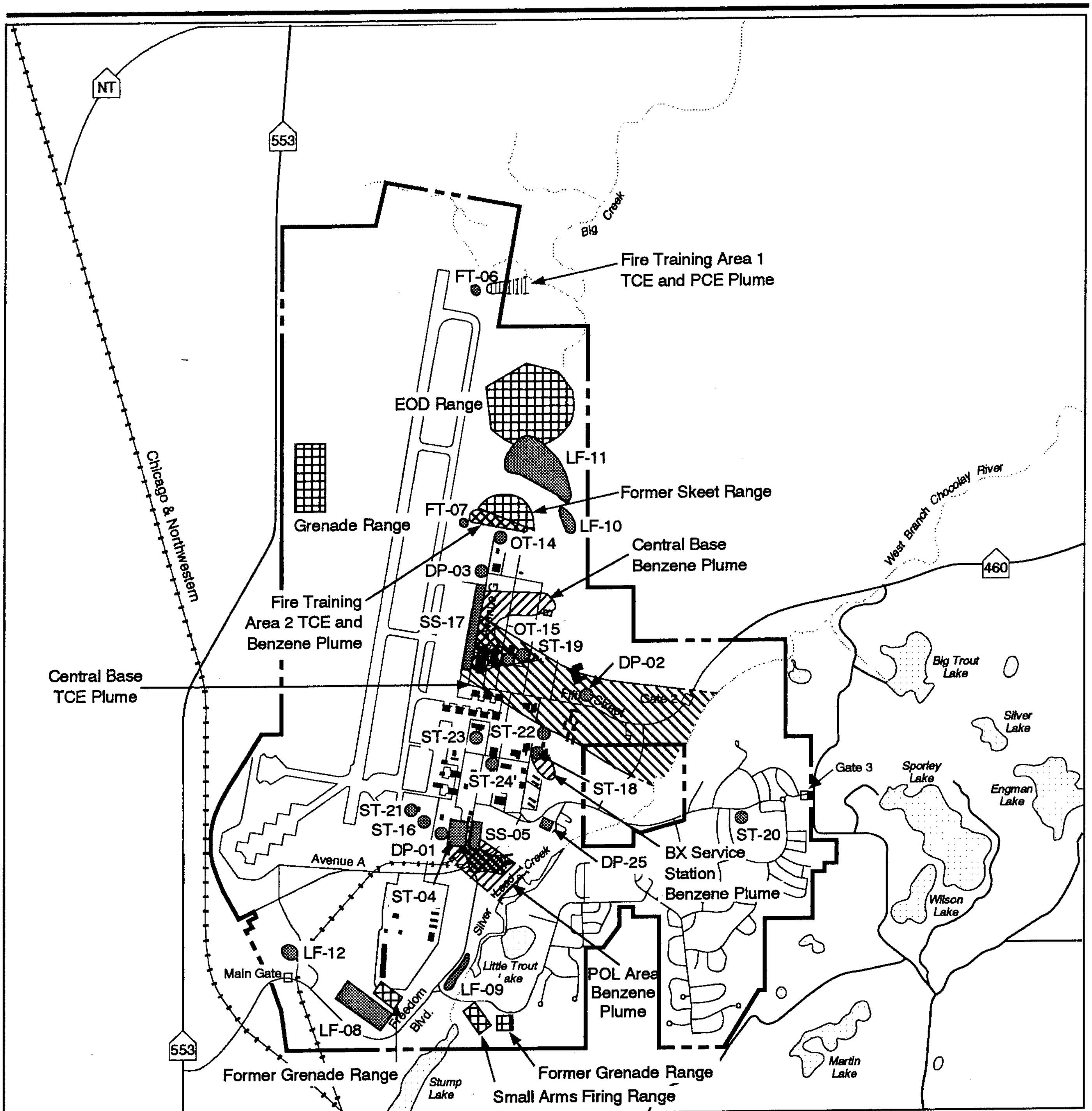
An RI is similar to the original Phase II and consists of additional fieldwork and evaluations to assess the nature and extent of contamination. It includes a risk assessment and determines the need for site remediation.

The original IRP Phase IV has been replaced by the FS and the RD within the third stage. The FS documents the development, evaluation, and selection of alternatives to remediate the site. The selected alternative is then designed (RD) and implemented (RA). Long-term monitoring is often performed in association with site remediation to ensure future compliance with contaminant standards or achievement of remediation goals. The Phase III portion of the IRP process is not included in the normal SARA process. TD under SARA is done under separate processes, including the Superfund Innovative Technology Evaluation program. The Air Force has an active TD program in cooperation with the U.S. EPA to find solutions to problems common to Air Force facilities.

The closure of K. I. Sawyer AFB will not affect ongoing IRP activities. These IRP activities, managed by the OL, will continue in accordance with federal, state, and local regulations to protect human health and the environment, regardless of the disposal decision. The establishment of the RAB allows for joint involvement in the IRP by the Air Force, federal and state regulators, and the local community. The Air Force will retain any necessary interests (e.g., easements) in order to perform operations and maintenance on all remediation systems.

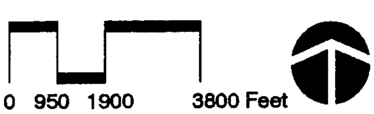
The public may keep abreast of the IRP at K. I. Sawyer AFB through various sources of information including the viewing of IRP documents contained in the Administrative Record at the Peter White Public Library in Marquette. The Air Force will present the results of RI/FS to the RAB, which will include a discussion of alternatives being considered. The RAB will also be informed of cleanup methods being selected and will have the opportunity to provide comments. The BCT will consider any comments before final acceptance of methods selected.

Preclosure Reference. Because the Air Force began the IRP process at K. I. Sawyer AFB in 1984, prior to terminology and procedural changes, both phases and stages are contained in the IRP Administrative Record. The Phase I - Records Search was published in September 1985 and initially identified 15 potential contamination sites (Figure 3.3-2): five landfills (Sites LF-08, LF-09, LF-10, LF-11, LF-12); three waste discharge areas (Sites DP-01, DP-02, DP-03); two fire training areas (Sites FT-06, FT-07); two petroleum, oil, and lubricant (POL) storage areas (Sites ST-04, OT-13); two hazardous substance storage facilities (Sites OT-14, OT-15); and the DRMO Storage Yard (Site SS-05). Thirteen of these sites were scored using the



EXPLANATION

- Benzene in Groundwater
- TCE in Groundwater
- IRP Site
- Ordnance Related Ranges
- Free Product Plume (JP-4)
- Base Boundary
- TCE and PCE in Groundwater



Note: Plume boundaries not fully characterized.

Installation Restoration Program (IRP) Sites and Related Groundwater Contamination; EOD Range, Grenade Ranges, and Small Arms Firing Range

Figure 3.3-2

Hazard Assessment Ranking Methodology (HARM) to assess their potential for contamination and to establish investigation priorities. These 13 sites were then recommended for further investigations to assess possible soil and groundwater contamination. Although not HARM scored or considered for additional evaluation, Sites OT-14 and OT-15 were retained as IRP sites. A description of each site's location and contamination is provided in Table 3.3-2; detailed site descriptions appear in Appendix D. A Decision Document was approved by the Air Force in 1990 supporting the transfer of the Wells Terminal Annex (Site OT-13), approximately 55 miles south of K. I. Sawyer AFB, to the Defense Logistics Agency (DLA). The DLA is now responsible for remediation of the Wells Terminal Annex; therefore, no reference to this site appears in Figure 3.3-2, Table 3.3-2, or Appendix D.

In 1986 and 1987, the U.S. Geological Survey (USGS) conducted a Phase II, Stage 1 Confirmation/Quantification Study. The study consisted mainly of an initial hydrogeologic survey at four areas on base in which the USGS installed monitoring wells and collected samples to characterize the nature and extent of soil and groundwater contamination. Hydrogeological models were also developed to determine area groundwater characteristics. The study concluded that the investigations did not fully identify the extent of groundwater contamination and that the installation of additional monitoring wells was needed at all sites. Additionally, the area of groundwater contamination associated with the POL Storage Area (Site ST-04) was recommended for additional studies to determine if fuels were floating on the water table and to determine the amount of fuels retained in the soils. Groundwater in the central portion of the base was identified as containing elevated levels of trichloroethylene (TCE) and benzene. This led to the installation of additional monitoring wells, including six east of Silver Lead Creek, to define the contamination plume boundary and its downgradient migration. As a result, a Phase II, Stage 2 study was implemented in late 1987 to better determine the extent of groundwater contamination, as well as to conduct supplemental studies of various sites.

Based on the recommendations of the 1987 Phase II, Stage 2 Study, a pilot-scale free product recovery study was conducted from November 1990 to January 1991 at one of the POL storage areas (Site ST-04). The 12-week study compared an active (pump and treat) system and a passive (skimmer) system for the removal of floating hydrocarbon contaminants from the groundwater surface. The study identified potential sources of contamination, determined the extent of the free product, and recommended soil vapor extraction as a likely method of treating the contaminated soils. The study also recommended additional investigations to further delineate the extent of groundwater contamination and determine if the active system was more effective for removing contaminants from the groundwater than the passive system.

Table 3.3-2. Summary of Installation Restoration Program Sites
Table 1 of 4

Site No.	Site Description/Location	Operable Unit (OU)	Location and Waste Description
DP-01	Drainage Pond No. 1	OU-1	In the southern portion of the base between the POL Storage Area and Building 414 - the former engine test cell. Shop wastes including solvents, jet fuel, oils, and paints may have contaminated soils and groundwater. RI/FS is under way.
DP-02	Drainage Pond No. 2	OU-2	In the central portion of the base adjacent to Fifth Street, between the Hospital (Building 850) and Avenue A-A. Site acted as a storm water discharge area for flightline shops. Wastes discharged include POL, fuels, and solvents (including TCE). Interim RA is under way.
DP-03	Drainage Pond No. 3	NA	Near the intersection of Avenue G and Eleventh Street, in the northern industrial portion of the base. The site received run-off from flightline maintenance areas; wastes may include POL, fuels, cleaning compounds, and antifreeze. Topsoils were removed in 1994 and the site is recommended for no further action.
ST-04	POL Storage Area	OU-1	In the southern portion of the base on the west side of Avenue D. The area is used for storage of bulk fuels, such as JP-4 and diesel fuel, and propylene glycol (deicing fluid). Soil and groundwater contamination has resulted from the past release of these materials. Site is undergoing interim RA in addition to RI/FS.
SS-05	DRMO Storage Yard	OU-1	In the southern portion of the base, east of Avenue D between the POL Storage Area and the central heating plant. The site is the hazardous waste storage area on base. Drummed wastes include POL, solvents, fuels, and PCBs. Site is undergoing interim RA in addition to RI/FS.
FT-06	Fire Training Area No. 1	NA	In the northern portion of the base, north of the primary taxiway. Past fire training operations burned waste fuels, oils, paints, thinners, degreasers, and hydraulic fluids, which have contaminated the soils. Site is undergoing interim RA in addition to RI/FS.

DRMO = Defense Reutilization and Marketing Office
NA = not applicable
PCB = polychlorinated biphenyl
POL = petroleum, oil, and lubricant
RA = Remedial Action
RI/FS = Remedial Investigation/Feasibility Study
TCE = trichloroethylene

Table 3.3-2. Summary of Installation Restoration Program Sites
Page 2 of 4

Site No.	Site Description/Location	Operable Unit (OU)	Location and Waste Description
FT-07	Fire Training Area No. 2	NA	In the northern portion of the base immediately north of the new control tower (Building 747). JP-4 was utilized as an ignition source during past fire training exercises, which has led to soil contamination. Site is undergoing interim RA in addition to RI/FS.
LF-08	Landfill No. 1	NA	In the southern portion of the base between Freedom Boulevard and the Weapons Storage Area. Disposal wastes included solvents, acids, paints, and pesticides as well as fly ash, construction debris, and household refuse. Site is undergoing an RI/FS.
LF-09	Landfill No. 2	NA	Northeast of the intersection of Freedom Boulevard and Scorpion Street in the southern portion of the base. Industrial wastes disposed of included PCBs, fly ash construction debris, and household refuse. Site is undergoing an RI/FS.
LF-10	Landfill No. 3	NA	Northeast of the main industrial area at the northern end of Avenue B. Small amounts of industrial wastes, sewage sludge, and household wastes were disposed of on site. Site is undergoing an RI/FS.
LF-11	Landfill No. 4	NA	In the northern portion of the base, immediately south of the EOD range. Materials disposed of on site include shop wastes, pesticides (DDT), sewage sludge, household refuse, and hardfill. Site is undergoing an RI/FS.
LF-12	Hardfill Area No. 2	NA	Off Snow Road in the southwest portion of the base immediately north of the Main Gate. Site was used for disposal of hardfill, construction debris, and some PCB transformers. NFADD approved in 1994.
OT-14	Building 744	NA	In the northern portion of the industrial area at the end of Avenue G. Facility is used for storage of PCB transformers and other exterior electrical equipment. NFADD approved in 1994.

DDT = dichlorodiphenyltrichloroethane
EOD = explosive ordnance disposal
NA = not applicable
NFADD = No Further Action Decision Document
PCB = polychlorinated biphenyl
RA = Remedial Action
RI/FS = Remedial Investigation/Feasibility Study

Table 3.3-2. Summary of Installation Restoration Program Sites
Page 3 of 4

Site No.	Site Description/Location	Operable Unit (OU)	Location and Waste Description
OT-15	Building 707	NA	In the northern industrial area near the intersection of Avenue D and Seventh Street. Site contamination may have occurred due to pesticide spills, including DDT. NFADD approved in 1994.
ST-16	Soil Remediation Area	NA	In the southern portion of the base between the former fighter alert hangar (Building 400) and Building 402. Site consisted of a soil stockpile area where contaminated soils discovered during UST removals underwent on-site low temperature thermal treatment to remove contaminants such as waste oil, JP-4, and gasoline. Soil treatment has been concluded; RI/FS is under way.
SS-17	Avenue G JP-4 Spill	OU-2	In the northern industrial area between the SAC operational apron and Avenue G. Spills have contaminated soil and groundwater with JP-4, benzene, and toluene. RI/FS is ongoing.
ST-18	Base Exchange Service Station USTs	OU-2	At Building 826 in the central portion of the base, near the intersection of Avenue A and Third Street. Leaking USTs have contaminated soils and local groundwater with gasoline and waste oil. RI/FS is ongoing.
ST-19	Building 709 USTs	OU-2	In the northern industrial area, at the end of Avenue G near Seventh Street. Leaking USTs have contaminated soils with diesel fuel and waste oil. RI/FS is ongoing.
ST-20	Building 1247 USTs	NA	In the eastern portion of K. I. Sawyer AFB near the intersection of Voodoo Avenue and Explorer Street. Leaking USTs have contaminated soils with gasoline (possibly leaded gas). RI/FS is complete. Decision document is under review.
ST-21	Building 436 USTs	NA	Was in the southern portion of the flightline between the former fighter alert hangar (Building 400) and Building 402. Leaking USTs may have contaminated soils with solvents and petroleum constituents. RI/FS is ongoing.

DDT = dichlorodiphenyltrichloroethane
NA = not applicable
NFADD = No Further Action Decision Document
RI/FS = Remedial Investigation/Feasibility Study
SAC = Strategic Air Command
UST = underground storage tank

Table 3.3-2. Summary of Installation Restoration Program Sites
Page 4 of 4

Site No.	Site Description/Location	Operable Unit (OU)	Location and Waste Description
ST-22	Building 824 USTs	NA	In the central portion of the base, across Avenue A from the Non-Commissioned Officers' Club. USTs were removed in 1992 and contaminated soils were removed to Site ST-16. Site has been recommended for no further action.
ST-23	Building 610 USTs	NA	In the central portion of the base, east of Avenue F between Third and Fourth Streets. Leaking USTs may have released gasoline and JP-4 to the soils. RI/FS is ongoing.
ST-24	Building 534 USTs	NA	In the central portion of the base, near the intersection of Avenue D and Third Street. Leaking USTs may have released diesel fuel and gasoline (possibly leaded gas) to the soils. RI/FS is ongoing.
DP-25	Material Drying Beds	NA	Adjacent to the wastewater treatment plant in the central portion of the base. The presence of cadmium and perchloroethylene in soils may have resulted from disposal of sewage sludge during the 1960s and 1970s or from sand/grease trap sludge disposal from 1989 to 1993. Sludge beds currently inactive. RI/FS is under way.

NA = not applicable
RI/FS = Remedial Investigation/Feasibility Study
USTs = underground storage tanks

Ongoing monitoring of the Central Base TCE Plume resulted in a 1990 Decision Document recommending that an interim RA be conducted to control migration of the plume to protect two drinking water wells located east of Silver Lead Creek and downgradient from the plume. In 1991 an additional Decision Document, supported by a subsequent Environmental Assessment, addressed the construction of a pump-and-treat system to remediate contaminated groundwater and prevent further downgradient migration. The system was constructed in 1993 and began operating in 1994. The system will operate as an interim program. Fourteen wells extract water from both the upper aquifers and a lower, confined aquifer. Volatile organic compounds (VOCs) are then removed from the water by passing it through an air stripper. The air stripper is located at Building 7140, near the intersection of Fifth Street and Avenue BB.

Nine sites, consisting of the soil remediation site (Site ST-16), Avenue G JP-4 Spill (Site SS-17), six storage tank sites (Sites ST-18, ST-19, ST-20, ST-22, ST-23, and ST-24), and several underground vaults associated with Site ST-21, were added to the K. I. Sawyer AFB IRP in summer 1992 as a result of the basewide UST removal project conducted in 1991 and 1992. The addition of these sites and the transfer of the Wells Terminal Annex to the DLA in 1990 brought the number of IRP sites at K. I. Sawyer AFB to 24.

The Soil Remediation Area (Site ST-16) was a stockpile of petroleum-contaminated soils that was created during the removal and/or replacement of USTs at Sites ST-18 to ST-24. Due to state regulations and local landfill restrictions on petroleum-contaminated soils, remediation of the stockpiled soils was conducted on site in late 1993 by low-temperature thermal treatment (desorption). Thermal treatment of petroleum-contaminated soils at the Soil Remediation Area (Site ST-16) has been completed; however, site closure procedures have not been determined.

In 1991 an RI/FS for the five landfill sites was initiated to characterize on-site contamination, including further characterization of groundwater previously identified during the Phase II studies. Activities conducted under the RI/FS included the installation of additional monitoring wells and the sampling of soils and groundwater. Preliminary RI/FS findings in September 1992 were inconclusive. As a result, groundwater monitoring and soil sampling activities are continuing. However, an No Further Action Decision Document (NFADD) for Hardfill Area 2 (Site LF-12) was submitted to ACC, and later to state and federal regulators. The NFADD was based on soil sampling in 1991 during the RI/FS and similar sampling in 1986 and 1987 as part of the Phase II investigations, which failed to detect any suspected contaminants.

Additional NFADDs were submitted in September 1991 for Building 744 (Site OT-14) and Building 707 (Site OT-15) since no evidence of a release was identified. Sites OT-14 and OT-15 were originally identified during the

Phase I - Records Search, and were retained as IRP sites but never recommended for further evaluation. All NFADDs received regulator approval in spring 1994 and the sites have been closed.

Two Operable Units (OUs) were established in 1991. A number of IRP sites were grouped by similar contaminants or by geographic location to help accelerate or provide separate remediation activities. OU-1 consists of three adjacent sites: Drainage Pond No. 1 (Site DP-01), the POL Storage Area (Site ST-04), and the DRMO Storage Yard (Site SS-05). In August 1991, the base submitted NFADDs to SAC to remove Drainage Pond No. 1 (Site DP-01) and the DRMO Storage Yard (Site SS-05) from the K. I. Sawyer AFB IRP process. Phase II groundwater sampling for organics was conducted in 1986 and 1987, and all sample results were below detection levels for organic contaminants at these sites. However, ACC has recently reopened the sites for investigation as part of the OU-1 RI/FS initiated in 1993. OU-2 consists of four sites associated with TCE and benzene groundwater contamination in the central base area: Drainage Pond No. 2 (Site DP-02), the Avenue G JP-4 Spill (Site SS-17), the Base Exchange Service Station USTs (Site ST-18), and the Building 709 USTs (Site ST-19). Investigations to identify the sources of groundwater contamination for OU-2 sites were initiated in summer 1994.

An interim RA is in progress at Site DP-02 (the central base groundwater pump and treatment system). Pilot study soil bioventing systems were installed as interim RAs at the POL Storage Area (Site ST-04) and the DRMO Storage Yard (Site SS-05) in 1992, and at Fire Training Area No. 1 (Site FT-06) and No. 2 (Site FT-07) in 1993 to remove organics from the soils. The capacity of this system to treat fuel-contaminated soils is being assessed; a final RA will be conducted following the completion of an RI/FS.

In the 1994 RI report for Sites FT-06 and FT-07, groundwater contamination in excess of MERA standards was confirmed at both sites. Site FT-06 was found to have TCE and tetrachloroethylene (PCE) in the groundwater that is moving in an easterly direction. TCE and benzene were identified moving in an easterly direction away from Site FT-07. Decision documents for these sites are scheduled to be submitted to regulators in summer 1995. These decision documents are likely to recommend additional groundwater investigations at Site FT-06 to determine the extent of contamination, as well as installation of a soil vapor extraction system as a means of soil remediation. Recommendations for Site FT-07 are likely to include continued groundwater monitoring and soil treatment by soil vapor extraction. Installation of soil vapor extraction systems are scheduled for fiscal year 1996 following regulator approval.

In 1994, base personnel identified the presence of cadmium and perchloroethylene at the Material Drying Beds in the central portion of the base adjacent to the WWTP. As a result, the area was included in the IRP

as Site DP-25; an RI/FS is scheduled to determine the extent of contamination. This site is believed to have received industrial wastes such as solvent, petroleum hydrocarbons, and heavy metals.

An RA at Site DP-03 was conducted in 1994. In addition, USTs and contaminated soils were removed from Site ST-22 in 1992. An NFADD has been approved for ST-22 and approval for DP-03 is expected in 1995.

Closure Baseline. The closure of K. I. Sawyer AFB will not affect the ongoing IRP activities, which will continue in accordance with U.S. EPA, state, and local regulatory agency regulations to protect human health and the environment, regardless of the alternative chosen for reuse. The BCT establishes joint involvement in the IRP among the U.S. Air Force, and federal and state regulators. The RAB involves the local community in the IRP process in an advisory capacity.

IRP remedial activities will continue well past the September 1995 closure date for K. I. Sawyer AFB. The schedule for future IRP activities is presented in Table 3.3-3. The Air Force will oversee coordination of the contractors and assure that U.S. EPA, MDNR, and local regulatory agency concerns are addressed. The Air Force will retain easements in order to perform operations and maintenance on all remediation and monitoring systems. Funding for the restoration activities at closure installations was authorized by Congress in 1991 specifically for that purpose. It is anticipated that future authorization acts will continue to fund environmental restoration activities at closing installations.

Prior to the transfer of any property at K. I. Sawyer AFB, the Air Force must also comply with the provisions of CERCLA § 120(h). CERCLA § 120(h) requires that, before property can be transferred from federal ownership, the United States must provide notice of specific hazardous substance activities and conditions on the property and, when there have been any such hazardous substance activities, include in the deed a covenant warranting that all RAs necessary to protect human health and the environment with respect to any hazardous substance remaining on the property have been taken before the date of such transfer. For all government transfers of this property by deed, a covenant will warrant that any additional RA found to be necessary after the date of such transfer shall be conducted by the U.S. Government. The combination of these requirements may delay parcel disposition or conveyance and affect reuse.

The Air Force is committed to the identification, assessment, and remediation of the contamination from hazardous substances at K. I. Sawyer AFB. This commitment will ensure the protection of public health, as well as restoration of the environment. Additionally, the Air Force will work aggressively with the regulatory community to ensure that parcel disposition or conveyance occurs on Air Force fee-owned land at the earliest reasonable

Table 3.3-3. K. I. Sawyer AFB IRP Document Delivery Schedule (as of March 1995)
Page 1 of 2

		IRP Phase							
Site/OU	Description	PA/SI	Remedial Investigation	Feasibility Study	Decision Document	Remedial Design	Remedial Action	Project Closeout	Long-Term Monitoring
OU-1	POL Storage Area OU[a]		May 1994	November 1994	March 1995	November 1996	May 1997[c]	November 1997	November 2000
OU-2	Central Base TCE and Benzene Groundwater Contamination OU[b]		April 1996	April 1996	August 1996	September 1996	August 1997	June 1999	June 2007
DP-03	Drainage Pond No. 3		May 1994	November 1994	June 1995		September 1994	November 1995	
FT-06	Fire Training Area No. 1		May 1994	April 1995	May 1995	May 1996	May 1997[c]	November 1999	November 2001
FT-07	Fire Training Area No. 2		May 1994	April 1994	May 1995	May 1996	May 1997[c]	November 1999	November 2001
LF-08	Landfill No. 1		June 1995	September 1995	December 1995	January 1996	June 1996	December 1997	November 2007
LF-09	Landfill No. 2		June 1995	September 1995	December 1995	January 1996	June 1996	December 1997	November 2007
LF-10	Landfill No. 3		June 1995	September 1995	December 1995	January 1996	June 1996	December 1997	November 2007

Notes: Sites LF-12, OT-14, OT-15, and ST-22 have been approved for no further action. Site DP-03 has been recommended for no further action. Site OT-13 was transferred to the Defense Logistics Agency in 1990.

(a) Contains Sites DP-01, ST-04, and SS-05.
(b) Contains Sites DP-02, SS-17, ST-18, and ST-19.
(c) Site undergoing interim removal action (see Table 3.3-2).

IRP = Installation Restoration Program
OU = Operable Unit
PA/SI = Preliminary Assessment/Site Inspection
POL = petroleum, oil, and lubricants
TCE = trichloroethylene

Table 3.3-3. K. I. Sawyer AFB IRP Document Delivery Schedule (as of March 1995)
Page 2 of 2

		IRP Phase							
Site/OU	Description	PA/SI	Remedial Investigation	Feasibility Study	Decision Document	Remedial Design	Remedial Action	Project Closeout	Long-Term Monitoring
LF-11	Landfill No. 4		June 1995	September 1995	December 1995	January 1996	June 1996	December 1997	November 2007
ST-16	Soil Remediation Site[d]							December 1996	
ST-20	Building 1247 USTs		May 1994	April 1994	May 1995	May 1996	November 1997	November 1999	November 2001
ST-21	Building 436 USTs		May 1994	April 1994	May 1995	May 1996	May 1997	September 1997	
ST-23	Building 610 USTs	November 1994	June 1995	July 1995	August 1995	March 1996	August 1996	November 1998	November 2001
ST-24	Building 534 USTs	November 1994	June 1995	September 1997	February 1995			February 1995	
DP-25	Material Drying Beds	October 1994	May 1996	June 1996	July 1996	August 1996	September 1996	November 1996	

Notes: Sites LF-12, OT-14, OT-15, and ST-22 have been approved for no further action. Site DP-03 has been recommended for no further action. Site OT-13 was transferred to the Defense Logistics Agency in 1990.

(d) Site will not undergo a Remedial Investigation/Feasibility Study; sampling of surrounding soils will be conducted prior to project closeout.

IRP = Installation Restoration Program
OU = Operable Unit
PA/SI = Preliminary Assessment/Site Inspection
UST = underground storage tank

date so as not to impede the economic redevelopment of the area through reuse of K. I. Sawyer AFB. Quantification of those delays based on the conceptual plans for all redevelopment alternatives and what is currently known at this stage of the IRP is not possible.

3.3.4 Storage Tanks

USTs are subject to RCRA, 42 U.S.C. 6991, and U.S. EPA implementing regulations 40 CFR 280. These regulations were mandated by the Hazardous and Solid Waste Amendments of 1984. In Michigan, USTs are regulated under the State Underground Storage Tank Act, Public Act 423 of 1984, as amended. The MDNR and the Fire Marshal Division of the State Police enforce the regulations set forth under this act. Additionally, leaking USTs are regulated under the Michigan Leaking Underground Storage Tank Act, Public Act 478 of 1988, as amended.

Management of aboveground storage tanks is conducted using the Flammable and Combustible Liquids code provisions of the National Fire Protection Association guidelines. The Michigan Fire Marshal is authorized to enforce these guidelines, which are adopted by reference under Act 207, the Michigan Fire Protection Code.

Preclosure Reference. Storage tanks at K. I. Sawyer AFB are listed in Appendix G. Sixty-nine USTs are in place at K. I. Sawyer AFB, of which 44 are regulated by the MDNR. With the exception of the 2,000-gallon waste oil USTs at Facilities 521 and 664, and a 4,000-gallon JP-4 UST in the POL yard (Facility 405), the remaining 41 USTs are double-walled with automated leak detection and spill, overfill, and corrosion protection installed, thus, meeting 1998 federal tank standards. Storage tanks of less than 1,000 gallons or tanks used for domestic heating fuel are not regulated by the state.

The Underground Storage Tank Management Plan (U.S. Air Force, 1990c) outlines K. I. Sawyer AFB's program to meet federal and state laws governing the testing, upgrading, and replacement of USTs. The base plans to remove all USTs not in compliance with 1998 standards.

All known heating oil USTs associated with military family housing units were removed during the conversion to natural gas in 1990, with the exception of 13 heating oil USTs that remained in place among the temporary lodging facilities until their removal in 1994. Eleven heating oil USTs at facilities that have been converted to propane or natural gas were removed in 1994. An additional five active heating oil USTs are scheduled for removal and their associated facilities are scheduled to be converted to either natural gas or propane in 1995. A detailed inventory of USTs is provided in Appendix G.

Aboveground storage tanks are subject to regulation under the Clean Water Act (33 U.S.C. §§ 1251-1278) oil pollution provisions. The operation and construction of aboveground storage tanks are also subject to National Fire Protection Association fire codes and the Uniform Fire Code.

K. I. Sawyer AFB has 147 aboveground storage tanks on base. An inventory of these storage tanks is provided in Appendix G. Five aboveground storage tanks are inactive; 20 are associated with emergency power generators and range in size from 100 to 500 gallons.

The POL storage yard is in the southern portion of the base and contains five aboveground storage tanks with a total capacity of 3,255,000 gallons; they range in size from 210,000 gallons to 1,575,000 gallons (see Appendix G). The POL yard is utilized mainly for storage and distribution of JP-4, although diesel fuel and propylene glycol (deicing fluid) are also stored there. A 6-inch pipeline operated by the National Pipeline Company supplied JP-4 to K. I. Sawyer AFB. The pipeline originates approximately 55 miles south of the base at the Wells Terminal Annex at Escanaba, Michigan, which is operated by DLA. Operation of the pipeline ceased in June 1994 with the reduction of aircraft activity on base. The JP-4 supplied by the pipeline was stored at the POL yard and eventually transferred to 20 50,000-gallon USTs located at four flightline pumphouses that serviced 40 aircraft fueling hydrants. The POL yard and flightline hydrant fueling system are operated by the Fuels Management Branch. The USTs associated with the flightline hydrant fueling system are exempt from regulations under 40 CFR 280 because they were constructed in place as part of the system.

K. I. Sawyer AFB operates 13 oil/water separators, which range in size from 20 to 67,000 gallons and are located throughout the industrial areas. An inventory of these oil/water separators is provided in Appendix G.

Closure Baseline. USTs that meet state regulations will be removed unless identified to support specific reuse activities. USTs that do not meet current regulations will be deactivated and removed prior to disposal by deed. The aboveground storage tanks will be emptied, purged of fumes to minimize fire hazards, and secured (safeguarded against trespassing) at base closure. These operations will be monitored by the Fire Marshal Division of the Michigan State Police. If not identified for reuse, sections of the hydrant fueling system located under parking aprons or taxiways are anticipated to be purged of product and closed in place. All oil/water separators will be pumped and cleaned of any contaminants.

3.3.5 Asbestos

Asbestos-containing building material abatement is regulated by the U.S. EPA, Occupational Safety and Health Administration (OSHA), the Michigan Department of Public Health, and the MDNR-Air Quality Division

(MDNR-AQD). Asbestos fiber emissions into ambient air are regulated in accordance with Section 112 (42 U.S.C. 7412) of the Clean Air Act (CAA), which establishes the National Emissions Standards for Hazardous Air Pollutants (NESHAP). The NESHAP regulations address the demolition or renovation of buildings with ACM. The Toxic Substances Control Act (TSCA), 15 U.S.C. 2601 et seq., and the Asbestos Hazard Emergency Response Act (AHERA), P.L. 99-519 and P.L. 101-637, provide the regulatory basis for handling ACM in kindergarten through 12th grade school buildings. AHERA and OSHA regulations cover worker protection for employees who work around or abate ACM.

Asbestos emissions are managed under the Michigan Air Pollution Control Rules (R336.1101 et seq.) and enforced by MDNR-AQD.

Renovation or demolition of buildings with ACM has a potential for releasing asbestos fibers into the air. Asbestos fibers could be released due to disturbance or damage from various building materials, such as pipe and boiler insulation, acoustical ceilings, sprayed-on fireproofing, and other material used for soundproofing or insulation.

Preclosure Reference. The current Air Force practice is to manage or abate ACM in active facilities and remove any ACM that has been identified as a hazard to human health, following regulatory requirements, prior to facility demolition. Removal of ACM occurs when there is a potential for asbestos fiber release that would affect the environment or human health. The Air Force policy concerning the management of ACM for base closures can be found in Appendix H.

An asbestos survey of 121 facilities was conducted at K. I. Sawyer AFB in August and September 1992. The survey included the Child Care Center, Youth Center, airmen's dormitories, and industrial facilities. ACM was found in 108 buildings surveyed; the survey results, by facility, are summarized in Appendix H.

An asbestos survey of 78 military family housing units at K. I. Sawyer AFB was conducted during summer 1994. This survey consisted of a visual inspection and sampling of each type of military family housing unit. ACM was found in each unit surveyed.

The Asbestos Management Plan and the Asbestos Operations Plan (U.S. Air Force, 1992a) describe identification, abatement, and disposal of ACM at K. I. Sawyer AFB. The plans also outline responsibility assignments and procedures to provide for proper management of ACM. The implementation of these plans is the responsibility of base Civil Engineering. Bioenvironmental Engineering supports Civil Engineering by conducting site surveys, bulk sampling, and air monitoring. Bioenvironmental Engineering personnel also monitor asbestos abatement projects, which can be

performed by the on-base asbestos abatement team or by an outside contractor.

Closure Baseline. Asbestos will be abated, as necessary, to protect human health. Beyond that, an analysis will be conducted to determine the cost effectiveness of removing ACM versus the impacts of ACM on the market value of the property, when sale of the Air Force property is planned. ACM will be removed if a building is, or is intended to be, used as a school or child care facility. Exposed friable asbestos identified to be a health hazard will be abated in accordance with Air Force policy (Appendix H), and applicable health laws, regulations, and standards.

3.3.6 Pesticide Usage

The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) 7 U.S.C. 136-136y regulates the registration and use of pesticides. Pesticide management activities are subject to federal regulations contained in 40 CFR 162, 165, 166, 170, and 171. State regulations are promulgated under Act 171, the Pesticide Control Act of 1976 (as amended). Pest management activities at K. I. Sawyer AFB was conducted in accordance with Air Force regulations and management recommendations, which follow FIFRA.

Preclosure Reference. Pesticides was stored at the Pest Management Shop (410 CES/DEME-PM) (Building 414) and was applied by DOD and state-certified applicators; the base entomologist was responsible for overseeing all pesticide application on base. The base entomologist implemented the Pest Management Program at K. I. Sawyer AFB. The Pest Management Shop conducted basewide weed abatement, performs monthly inspections of dining halls, provided routine termite inspections, and inspected the hospital and child care facilities, as necessary. Pesticide usage was seasonal, although most was applied during the spring and summer; broadleaf herbicides were used during the late spring and early summer. Pesticides were mixed at the Pest Management Shop. Following a pesticide application, spray equipment tanks were triple rinsed with the rinsate disposed of by application; hand sprayers were also rinsed and the rinse waters discharged to the sanitary sewer for treatment at the WWTP. On-base pesticide application practices were regularly inspected by the base Bioenvironmental Engineer. Additional inspections include biennial Medical Entomological and annual Environmental Compliance Assessment and Management Program reviews by ACC. Herbicides, fungicides, and fertilizers were applied to the golf course in spring and summer; any additional weed abatement measures are provided by the Pest Management Shop on an as-needed basis. An inventory of pesticides commonly used at K. I. Sawyer AFB is presented in Appendix G.

All pesticides used by the Pest Management Shop have been procured through base supply, usually in a single bulk purchase. The majority of pesticides have been stored at the Pest Management Shop; additional herbicides, fungicides, and fertilizers were stored in a shed at the golf course grounds maintenance compound (Building 786) in the form of weed and feed formulas, which do not require a certification for application. The majority of pesticides used on base were for grounds and golf course maintenance and basewide pest management, although household pesticides were available at the Base Exchange (Building 632).

Closure Baseline. At base closure, pesticides will continue to be used on an as-needed basis for pest management and grounds maintenance. The OL will be responsible for managing the continued application of pesticides and ensuring that all applications are conducted in accordance with applicable regulations.

3.3.7 Polychlorinated Biphenyls

Commercial PCBs are industrial compounds produced by chlorination of biphenyls. PCBs persist in the environment, accumulate in organisms, and concentrate in the food chain. PCBs are used in electrical equipment, primarily in capacitors and transformers, because they are electrically nonconductive and stable at high temperatures.

The disposal of these compounds is regulated under the federal TSCA, which banned the manufacture and distribution of PCBs with the exception of PCBs used in enclosed systems. By federal definition, PCB equipment contains 500 parts per million (ppm) PCBs or more, whereas PCB-contaminated equipment contains PCB concentrations of 50 ppm or greater but less than 500 ppm. The U.S. EPA, under TSCA, regulates the removal and disposal of all sources of PCBs containing 50 ppm or more; the regulations are more stringent for PCB equipment than for PCB-contaminated equipment. The MDNR enforces a federal PCB compliance monitoring program under a cooperation agreement with the U.S. EPA.

Preclosure Reference. The Environmental Management Office was responsible for the management of PCBs at K. I. Sawyer AFB. Testing of all PCB-oil-containing equipment, including capacitors, regulators, oil switches, and transformers, was conducted in 1986 using chlorinol field test kits. All electrical equipment identified as containing concentrations of PCBs above 50 ppm was then sampled by a laboratory to verify the initial test results. Additional laboratory sampling was conducted in 1993 on all PCB-oil-containing equipment remaining in service following the 1986 PCB survey. Following the 1993 sampling, all PCB-oil-containing equipment at K. I. Sawyer AFB was removed or retrofilled; therefore, no PCB equipment or PCB-contaminated equipment remains at K. I. Sawyer AFB.

Closure Baseline. There is no federally regulated PCB or PCB-contaminated equipment at K. I. Sawyer AFB.

3.3.8 Radon

Radon is a naturally occurring, colorless, and odorless radioactive gas that is produced by radioactive decay of naturally occurring uranium. Uranium decays to radium, of which radon gas is a by-product. Radon is found in high concentration in rocks containing uranium, such as granite, shale, phosphate, and pitchblende. Atmospheric radon is diluted to insignificant concentrations. Radon that is present in soil, however, can enter a building through small spaces and openings, accumulating in enclosed areas, such as basements. The cancer risk caused by exposure, through the inhalation of radon, is currently a topic of concern.

There are no federal or state standards regulating radon exposure at the present time. The U.S. EPA offers a pamphlet, "A Citizen's Guide to Radon" (U.S. EPA, 1992a), which offers advice to persons concerned about radon in their homes. U.S. Air Force policy requires implementation of the Air Force Radon Assessment and Mitigation Program (RAMP) to determine levels of radon exposure of military personnel and their dependents. The U.S. EPA has made testing recommendations for both residential structures and schools. For residential structures, using a 2- to 7-day charcoal canister test, a level between 4 and 20 picocuries per liter (pCi/l) should lead to additional screening within a few years. For levels of 20 to 200 pCi/l, additional confirmation sampling should be accomplished within a few months. If the level is in excess of 200 pCi/l, the structure should be evacuated immediately. Schools are to use a 2-day charcoal canister test; if readings are 4 to 20 pCi/l, a 9-month school year survey is required. If all readings are below 4 pCi/l, no further action is recommended. Table 3.3-4 summarizes the recommended radon surveys and action levels.

Preclosure Reference. A radon screening survey was conducted at K. I. Sawyer AFB in May 1988 by the base Bioenvironmental Engineer. The survey consisted of 34 samples taken from military family housing units, billeting, airmen's dormitories, and the Child Care Center. All samples resulted in radon levels below the U. S. EPA's recommended mitigation level of 4 pCi/l. Therefore, a detailed assessment survey was not needed and mitigation activities were not necessary or advised.

Closure Baseline. Radon screening sample results were all below 4 pCi/l; therefore, no further action is necessary.

Table 3.3-4. Recommended Radon Surveys and Mitigations

Facility	U. S. EPA Action Level[(a)]	Recommendation
Residential	4 to 20 pCi/l	Additional screening. Expose detector for 1 year. Reduce radon levels within 3 years if confirmed high readings exist
Residential	20 to 200 pCi/l	Perform follow-up measurements. Expose detectors for no more than 6 months
Residential	Above 200 pCi/l	Follow-up measurements. Expose detectors for no more than 1 week. Immediately reduce radon levels
	Two-Day Weekend Measurement	
School	4 to 20 pCi/l	Confirmatory 9-month survey. Alpha track or ion chamber survey
School	Greater than 20 pCi/l	Diagnostic survey or mitigation

Notes: Congress has set a national goal for indoor radon concentration equal to the outdoor ambient levels of 0.2 to 0.7 pCi/l.
(a) For levels below 4 pCi/l, no further action is recommended.
EPA = Environmental Protection Agency
pCi/l = picocuries per liter

Source: U.S. EPA, 1992b.

3.3.9 Medical/Biohazardous Waste

Disposal of medical waste is regulated under 40 CFR Part 259, Standards for the Tracking and Management of Medical Waste. The state regulates medical waste under the Michigan Medical Waste Management Act, Michigan Compiled Laws Annotated, Chapter 333 - Public Health Code Part 138.

Preclosure Reference. K. I. Sawyer AFB operates a 15-bed hospital (Building 850) that provides inpatient services, such as general surgery, radiology, maternity and obstetrics, family practice, flight surgeon, and an extended hours clinic, as well as outpatient care. The dental clinic is in the same facility and both provide services to active duty military personnel and their dependents, as well as military retirees and their dependents.

The Medical Waste Minimization Plan identifies, manages, and provides waste minimization guidelines for medical wastes generated at K. I. Sawyer AFB. The 410th Medical Group is responsible for implementation of the plan.

The hospital and dental clinic generate approximately 1,000 pounds of medical waste monthly. The waste is properly bagged, boxed, and disposed of off base by a contractor on a weekly basis. Hospital personnel dispose of expired pharmaceuticals using the Military Item Disposal Instructions and Military Environmental Information Source guidelines published by the U.S. Army Environmental Hygiene Agency.

Photochemical wastes are generated at four locations on base. The radiology laboratory, dental clinic (Building 850), Combat Camera (Building 601), and the Non-Destructive Inspection (NDI) Laboratory (Building 725) generate photochemical wastes and also process these wastes using silver recovery units. The silver recovery units remove silver from photographic developing solution through a cartridge system; the silver is then sold through DRMO, and the remaining solution is discharged to the sanitary sewer.

Closure Baseline. The hospital and dental clinic will be inactive; therefore, no biohazardous waste will be generated at base closure. Existing biohazardous waste will be processed and removed prior to closure in accordance with appropriate federal and state regulations.

3.3.10 Ordnance

Preclosure Reference. K. I. Sawyer AFB operates an EOD range, a 40-millimeter (mm) grenade range, and a small arms firing range. Two former grenade ranges and an inactive skeet range are also on base.

The EOD range consists of a circular area with a 1,250-foot radius in the northeast portion of the base (see Figure 3.3-2). The range has been utilized for both burning and detonation of unserviceable ordnance since the early 1970s and operates under a RCRA Interim Part X permit status. Burning operations are conducted by using a "burn kettle" located in the center of the range. Ordnance is placed into the kettle and destroyed using diesel fuel as an ignition source. Materials disposed of by burning include small arms ammunition, smoke grenades, flares, impulse cartridges, and jet engine starter cartridges. Burning operations ceased in 1991, with the exception of a single burn conducted in February 1993. Burn residue is disposed of through DRMO.

Ordnance disposal, by way of detonation, was conducted by digging a blasting pit in the center of the range, placing an explosive charge on the unserviceable munitions, and detonating the charge. All surface residue is then collected and disposed of through DRMO and the pit is backfilled. Materials destroyed through detonation consist mainly of flares and bomb fuses. Ordnance disposal took place on a quarterly basis until 1992.

The small arms firing range is on Scorpion Street in the southern portion of the base and consists of an outdoor rifle range (Building 5023), the M-60 machine gun range (Building 868), and an administrative classroom facility (Building 866). The rifle range has been in operation since the mid-1950s and is used almost daily for qualifying Air Force personnel in small arms proficiency. The range is also used by local National Guard Units, DOI, MDNR rangers, and other organizations. The range is 100 yards long, with a number of wooden ricochet baffles and earthen berms on both sides and at the back of the range, and has 18 enclosed firing bays across the front.

The machine gun range is adjacent to the rifle range and has only two firing pits. The range is also enclosed by earthen berms and was constructed in 1988.

A 40-mm practice grenade range in the northwest portion of the base is used by the 410th Security Police Squadron during the summer months to qualify approximately 120 security personnel on a 40-mm grenade launcher. Only inert practice grenades loaded with a colored spotting charge are used at the range. The range impact zone is approximately 1,000 feet in length, with an additional 500-foot safety zone. The range has been in operation since 1980.

There are two former grenade ranges in the southern portion of the base. One former grenade range is directly south of the Air Launch Cruise Missile storage area. Practice hand grenades, as well as 40-mm practice grenades, were believed to have been used during security police training. This range was deactivated in 1985, and a partial range decontamination project covering a 16-acre area was conducted in 1984 to accommodate the expansion of the Air Launch Cruise Missile storage area (U.S. Air Force, 1985). The other former grenade range was east of the small arms firing range and south of Scorpion Street. This range was active from 1979 to 1982. When this range was deactivated, all practice grenades were cleared from the area and hauled to an on-base landfill. Additionally, a skeet range in the wooded area at the north end of Avenue G was in operation during the 1980s.

Except for the partial decontamination of the former grenade range, none of the previously mentioned ranges have been cleared of ordnance; clearance status of these ranges is unknown. However, all ordnance-related sites were identified as SWMUs or AOCs during the 1992 PR/VSI and by base personnel in 1994, and will be investigated to determine the presence or absence of remaining ordnance or related contamination, and remediated if necessary.

Closure Baseline. All accumulated ordnance will be properly packaged and transported off base for utilization or disposal by other Air Force units. The EOD range, grenade range, and former grenade range will be cleared of all

unexploded ordnance. The small arms firing range will be inspected and certified as cleared of unexploded ordnance prior to property disposal by deed.

3.3.11 Lead-Based Paint

Human exposure to lead has been determined to be an adverse health risk by agencies such as OSHA and U.S. EPA. Sources of exposure to lead are dust, soils, and paint. Waste containing levels of lead exceeding a maximum concentration of 5.0 milligrams per liter (mg/l) as determined using the U.S. EPA Toxic Characteristic Leaching Procedure that simulates the leaching behavior of landfill wastes, is defined as hazardous under 40 CFR 261. If a waste is classified as hazardous, disposal must take place in accordance with U.S. EPA and state hazardous waste rules.

In 1973, the Consumer Product Safety Commission (CPSC) established a maximum lead content in paint of 0.5 percent by weight in a dry film of newly applied paint; in 1978, under the Consumer Product Safety Act (P.L. 101-608 as implemented by 16 CFR 1303), the CPSC lowered the allowable lead level in paint to 0.06 percent. The Act also restricted the use of lead-based paints in nonindustrial facilities. In 1989, the U.S. EPA established a cleanup criterion for lead in soil of 500 to 1,000 ppm total lead when the possibility of child contact exists. Specific cleanup levels are based on the characteristics of individual sites. The Lead-Based Paint Poisoning Prevention Act, 42 U.S.C. 4821 et seq., as amended by the Residential Lead-Based Paint Hazard Reduction Act of 1992, requires that lead-based paint hazards in federal housing facilities be identified and eliminated. In 1993, the federal OSHA, under 29 CFR 1926, extended the permissible exposure limit for general industrial workers of 50 micrograms per cubic meter ($\mu g/m^3$) of air to include workers in the construction field.

To ensure that any threat to human health and the environment from lead-based paints has been identified, the residential Lead-Based Paint Hazard Reduction Act (Title X), effective January 1, 1995, and Air Force policy require that a lead-based paint survey of high-priority facilities be conducted at K. I. Sawyer AFB. High-priority facilities consist of facilities or portions of facilities frequented by children under the age of seven, and include military family housing, transient lodging facilities, DOD-maintained day care centers and elementary schools, and playgrounds. The survey will be conducted in accordance with the Air Force Guide for Lead-Based Paint investigations or based on HUD protocols. Lead-based paint identified on housing units constructed prior to 1960 will be abated in a manner that will permanently eliminate the lead-based paint hazards (i.e., paint removed from surface, painted surface material replaced). Finally, lead-based paint survey results and a lead-based paint warning statement will be provided to recipients prior to property transfer, in accordance with P.L. 102-550 Title X, Sections 1013 and 1018.

Preclosure Reference. In early 1991, a partial survey of military family housing units at K. I. Sawyer AFB identified the presence of lead-based paint. The survey consisted of windowsill and door frame paint samples taken from a cross-section of 33 housing units; only partial abatement occurred following the survey. The base housing office notified all new residents that lead-based paint may exist in that housing unit.

An additional lead-based paint survey was completed in September 1994. The survey covered 179 housing units, Child Care Center, hospital, pediatric ward, and Youth Center using an X-ray fluorescence spectrometer, which utilizes a radioactive source that allows for testing to be conducted in place without disturbing the painted surface. Additionally, HUD protocols were followed that required the testing of all painted components (walls, ceiling, windowsills, baseboards, shelves, etc.) in each room. All housing units were constructed prior to or during 1978; therefore, the physical condition of painted components was visually inspected for all remaining housing units. Results from the survey indicated the presence of lead-based paint in the Child Care Center, pediatric ward, and Youth Center. Of the 179 housing units surveyed, 74 percent contained lead-based paint.

Closure Baseline. The results for all lead-based paint surveys will be made available to all potential recipients of base property. In accordance with the Lead-Based Paint Hazard Reduction Act and Air Force policy, lead-based paint hazards will be abated from any housing structure constructed prior to 1960. Surfaces identified as containing lead-based paint in housing constructed between 1960 and 1978 will be identified to potential recipients prior to facility disposal.

3.4 NATURAL ENVIRONMENT

This section describes the affected environment for natural resources: geology and soils, water resources, air quality, noise, biological resources, and cultural resources.

3.4.1 Geology and Soils

Geology and soils include those aspects of the natural environment related to the earth, which may affect or be affected by the proposed base disposal and reuse. These features include physiography, geologic units and their structure, the presence/availability of mineral and related natural resources, the potential for natural hazards, and soil conditions and capabilities. Water resources, which are related to geology and soils, are described in Section 3.4.2.

In general, the ROI for geology is the regional geologic setting (to provide context) and specific features on the base (to determine impacts); the ROI for soils is the base area.

3.4.1.1 Geology

Physiography. K. I. Sawyer AFB is within the Superior Uplands physiographic province (Engineering-Science, 1985) of the north-central North American Craton. The physiography of the area is a slightly rolling plain, somewhat dissected by stream and river channels, with average elevations of 1,100 feet above MSL. On-base topography varies approximately 194 feet, which is caused by relict glacial features (e.g., kettles), dissection along drainages, and man-made changes to natural topography.

Geology. There are two general geologic units underlying the base: glacial deposits at the surface and Cambrian-Precambrian (greater than 500 million years old) sedimentary and metamorphic rocks. There are no known significant structural features (e.g., faults, folds, etc.) underlying the base.

The glacial deposits at and around the base are composed of ground moraine and outwash plain deposits (Gair and Thaden, 1968; Martin, 1957). These deposits are generally unstratified or poorly stratified sands, with variable but often small amounts of gravel, silt, and other particles. Locally, silt and clay layers are also found. The base is underlain by up to 300 feet of these deposits, which were the result of the Pleistocene glaciations that began approximately 2 million years ago and ended approximately 11,000 years ago. Holocene alluvium, which is younger than the glacial deposits and occurs locally along Silver Lead Creek, is composed of glacial deposits that have been transported and reworked by recent erosional action (U.S. Geological Survey, 1987).

Underlying the glacial deposits is Cambrian-Precambrian bedrock. Because there are limited subsurface data (e.g., well logs) that reach down to the bedrock in the area, published interpretations of the uppermost bedrock units underlying the base have suggested several possibilities: Cambrian limestones and sandstones (Cleveland-Cliffs Iron Co., 1989), the Upper Precambrian (800 million years to 1.7 billion years ago) Jacobsville Sandstone (Twenter, 1981), or the Archaean (lower Precambrian, older than 2.7 billion years old) Compeau Creek Gneiss (Grannemann, 1984; Doonan and VanAlstine, 1982). Yet other studies indicate that some or all of these units are found below the glacial deposits at the base (U.S. Geological Survey, 1987).

Natural Resources. Marquette County has contained some of the most significant known reserves of iron ore in North America, with over 500 million tons of iron ore being extracted since 1844 (Michigan Department of Natural Resources, 1978). In addition, the Upper Peninsula has been mined for copper ore, and to a lesser extent, gold, silver, and other ores (Fountain, 1992).

The Marquette Iron District, which includes numerous large open pit and subsurface iron mines, is within 10 miles northwest of the base; the district is centered on the towns of Negaunee and Ishpeming. The Gwinn district, which includes numerous inactive shaft mines, is less than 2 miles south of the base, near Gwinn. Because of the uncertainty of the underlying bedrock unit, the likelihood of mineral resources under the base is unknown. However, the most recent regional studies indicate that the base does not contain economic reserves of ore.

There are no mineral, oil and gas, or other similar leases for base property. For portions of the base leased to the Air Force, mineral or other rights are not part of the agreements.

Sand dunes are important natural landform resources in Michigan (as recreation areas), as well as sources of economic deposits of sand. There are no sand dune deposits on K. I. Sawyer AFB.

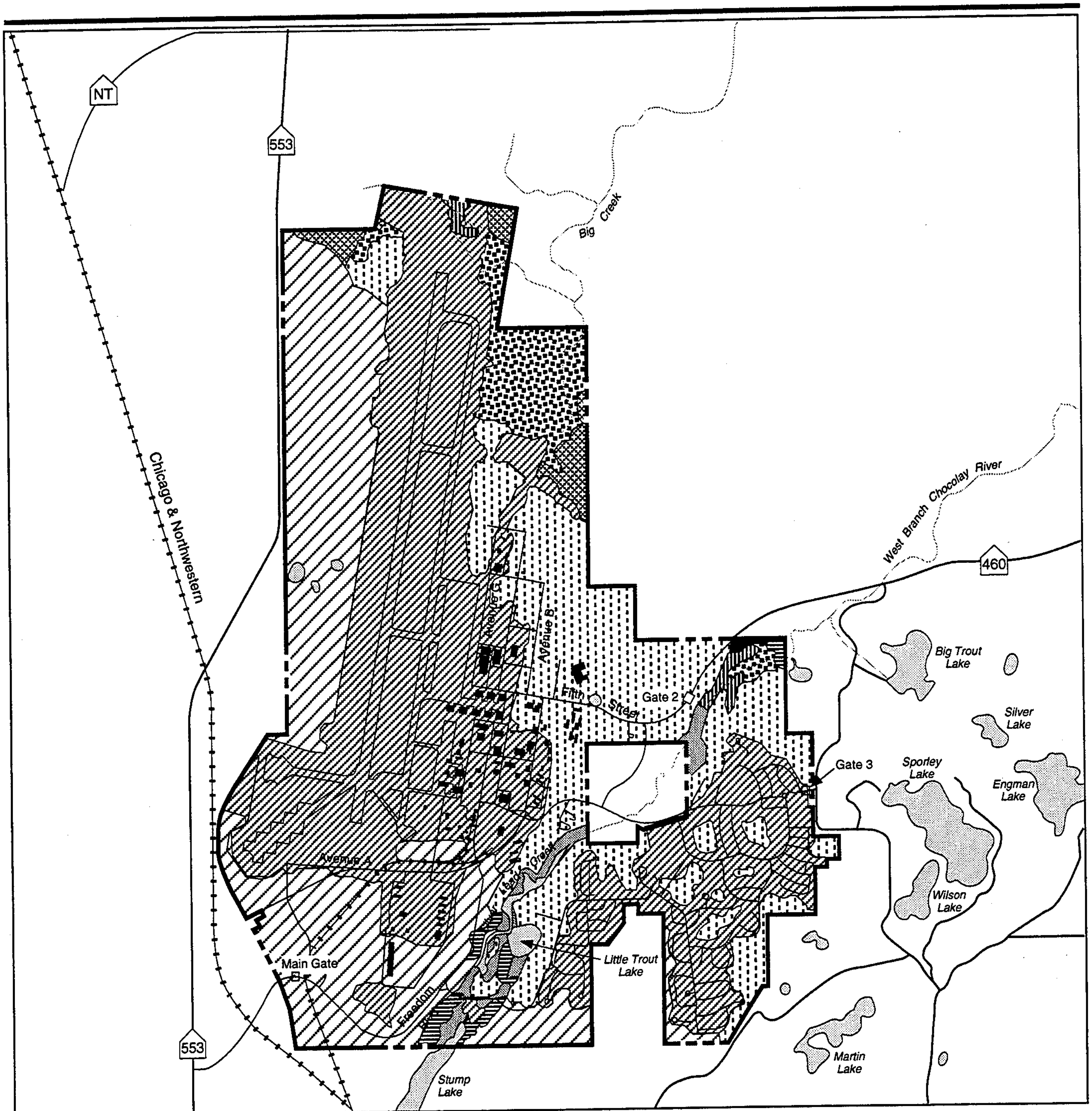
Marquette County also contains dolomite resources, large quantities of sand and gravel resources, and some crushed rock resources (Michigan Department of Natural Resources, 1978). The glacial deposits on the base could supply sand and gravel. Although the quality of the deposits has not been evaluated in detail, the unsorted nature of the glacial sediments suggests moderate to poor quality sand and gravel resources.

Natural Hazards. The base is located in Seismic Hazard Zone 0 (International Conference of Building Officials, 1991), which indicates the region has a low potential of sustaining major damage from a large earthquake. As a result, seismic safety is not a factor in design requirements from the Uniform Building Code for structures in the area.

Based on the local geology, there is little potential for ground collapse from sinkholes, landslides, liquefaction, or related natural hazards.

3.4.1.2 Soils. The Natural Resources Conservation Service (formerly Soil Conservation Service) has not yet published a Soil Survey for Marquette County, but they have completed mapping of the base in preparation for publication (U.S. Department of Agriculture, unpublished). The soils on base are generally sands and fine sands, with smaller areas of loamy sands, sandy loams, and organic (peat and muck) soils. Since much of the base has been modified during development, it is classified as disturbed (i.e., original soil characteristics have been destroyed). The organic soils are located along Silver Lead Creek, Stump Lake, and Little Trout Lake. The soils on base are shown on Figure 3.4-1 and selected characteristics are shown on Table 3.4-1.

The use of the soils on base can be summarized in two general groups: the organic soils in the Silver Lead Creek area and the upland areas on the



EXPLANATION

- Soil Boundary
- Base Boundary
- Disturbed
- Grayling
- Rubicon*
- Alcona*
- Keweenaw and Kalkaska*
- Rousseau*
- Water
- Stream Channel Complexes
- Stream Channels/Ponded
- Croswell

0 950 1900 3800 Feet

* Includes soil complexes containing these and other soils. (Table 3.4-1)

Source: U.S. Department of Agriculture, unpub.

Soils Distribution

Figure 3.4-1

Table 3.4-1. Selected Characteristics of Soils on K. I. Sawyer AFB

Soil Type	Texture	Slope (percent)	Permeability	Shrink-Swell	Erosion Potential	
					Water	Wind
Grayling	Sand	0-35	Rapid-very rapid	Low	Low	Very high
Rubicon	Sand	0-70	Rapid-very rapid	Low	Low	Very high
Kalkaska	Sand	6-18	Rapid-very rapid	Low	Low	Very high
Rousseau	Fine sand	18-35	Moderate-very rapid	Low	Low	Very high
Croswell	Sand	0-3	N/A	N/A	N/A	N/A
Rousseau-Ocqueoc	Find sand-sandy	0-6	Moderate-very rapid	Low	Low-moderate	Very high
Keweenaw	Loamy sand	18-35	N/A	N/A	N/A	N/A
Carbondale and Tawas Complex	Peat and muck	0-2	Moderately slow-very rapid	None-low	Low	Low-high
Greenwood and Dawson Complex	Peat and muck	0-2	Moderately slow-very rapid	None-low	Moderate	Low-high
Stream Channel/ Ponded	Variable	0-2	N/A	N/A	N/A	N/A
Disturbed	Sandy	0-3	N/A	N/A	N/A	N/A
Liminga-Alcona-Ocqueoc Complex	Sandy	0-70	Moderately slow-very rapid	Low	Low-moderate	Very high-high
Keweenaw-Steuben Complex	Loamy sand-sandy loam	0-30	Slow-very rapid	Low	Low-moderate	Very high-high
Sayner-Rubicon Complex	Sand	0-70	Moderate-very rapid	Low	Low	Very high
Alcona-Richter	Sandy loam	1-18	Moderately slow-rapid	Low	Low-moderate	Very high-high
Keweenaw-Kalkaska Complex	Loamy sand-sand	6-35	Rapid-very rapid	Low	Low	Very high

Note: Some of these units were combined on Figure 3.4-1.
N/A = not available

Source: U.S. Department of Agriculture, unpublished.

remainder of the base. The organic soils have severe restrictions on suitability for sanitary facilities, building development, and use as construction material. The upland areas have severe restrictions on sanitary facilities, are poor sources of gravel and topsoil, and have limited capability as water management areas, but generally have minimal restrictions on building sites (restrictions increase with slope) and are good sources of road fill and sand.

The base contains no mappable units of prime farmland soil. Some of the soil complexes (see Table 3.4-1) may contain small amounts of soils suitable as prime farmland, but in quantities too small to map individually (Evon, 1993).

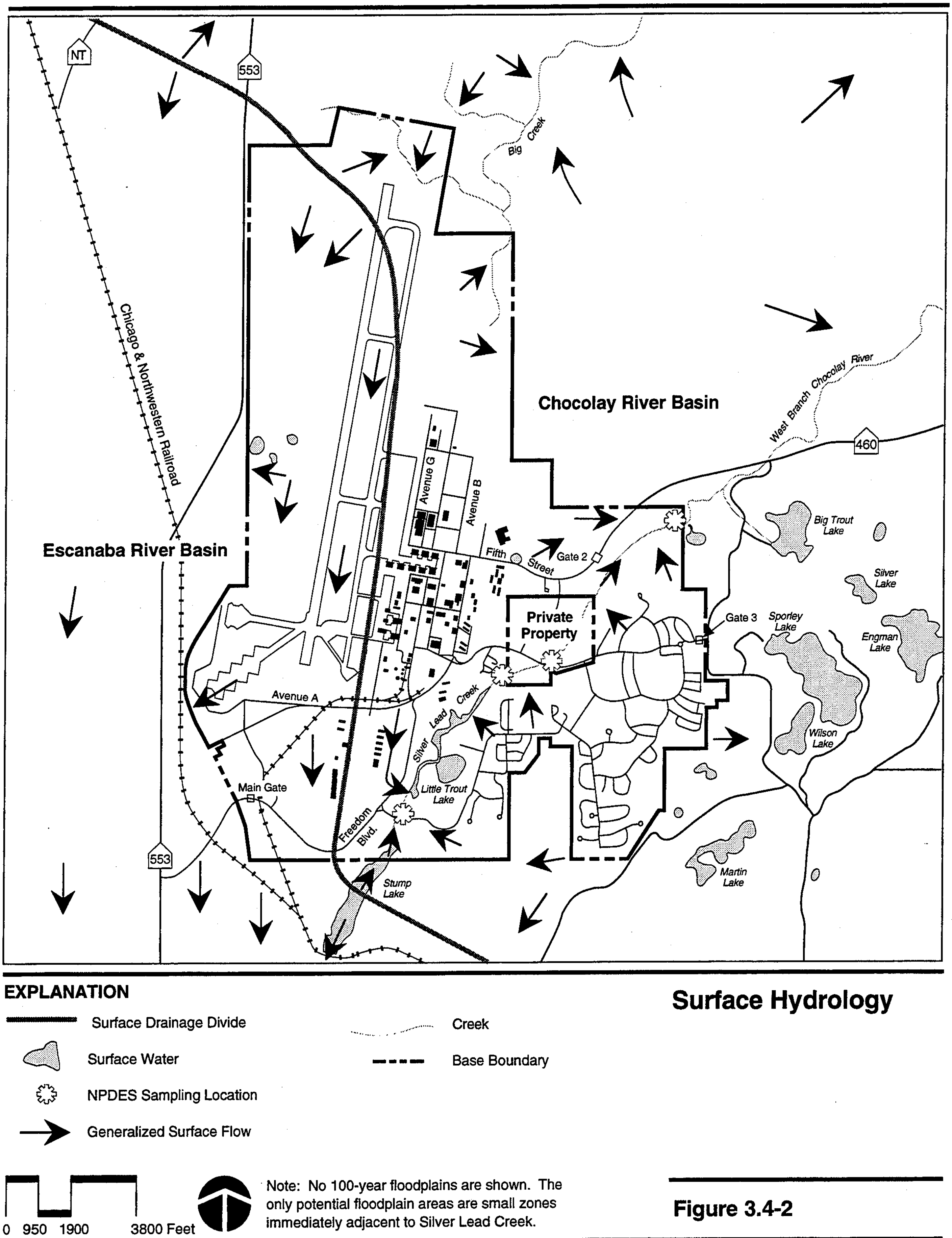
There are several locations on K. I. Sawyer AFB where soils are likely to be contaminated. These areas are under investigation under the IRP and facility assessment process to determine the extent of contamination. Descriptions and locations of these areas are found in Section 3.3, Hazardous Materials and Hazardous Waste Management.

3.4.2 Water Resources

Water resources include those portions of the natural environment related to surface water and groundwater. These water considerations include drainage/runoff, permanent surface water features, drinking water quality, water quality effects associated with effluent and non-point source (storm water runoff), NPDES requirements, floodplains, water supply capacity (surface or groundwater), and aquifer characteristics. Wetlands are considered as part of the biological resources analysis (Section 3.4.5.4, Sensitive Habitats), and existing water contamination associated with base operations is considered as part of the hazardous materials and hazardous waste management analysis (Section 3.3).

The ROI for surface water is the drainage system/watershed in which the base is located; the ROI for groundwater is the local aquifer(s) being used by the base.

3.4.2.1 Surface Water. Figure 3.4-2 shows the primary surface and groundwater hydrology characteristics at K. I. Sawyer AFB. Most of the base is in the Chocolay River Basin; portions of the western side of the base slope toward tributaries of the Escanaba River, which ultimately flows into Lake Michigan. The primary surface water features on base are associated with Silver Lead Creek, which flows northeast from Stump Lake at the south end of the base. Silver Lead Creek flows into the Chocolay River, which flows into Lake Superior. The north end of the base slopes toward Big Creek, which also flows into the Chocolay River.



Note: No 100-year floodplains are shown. The only potential floodplain areas are small zones immediately adjacent to Silver Lead Creek.

Surface Hydrology

Figure 3.4-2

K. I. Sawyer AFB has submitted an application for reissue of the expired 1988 NPDES permit for effluent discharge from its WWTP into Silver Lead Creek and disposal of effluent sludge. The application for renewal of the permit has not yet been reviewed by the MDNR; however, K. I. Sawyer AFB is authorized to operate under the expired permit. The base continues to meet all sampling, analysis, and reporting requirements established in the original permit.

The base operates under an Air Force nationwide permit for storm water runoff into surface waters and coordinates related issues with the MDNR.

The base has not been mapped in detail for 100-year floodplains; however, the high permeability and infiltration rates of the soils are such that flooding is unlikely. The only possible floodplain area is along Silver Lead Creek, Stump Lake, and Little Trout Lake, and flooding is very short term before water infiltrates the ground (U.S. Geological Survey, 1987). Mapping of soils by the Natural Resources Conservation Service indicates that only small portions of soil complexes mapped along the creek are occasionally or frequently flooded (U.S. Department of Agriculture, unpublished); therefore, the 100-year floodplains along the creek are expected to be in the immediate vicinity of the streambed.

3.4.2.2 Groundwater. The groundwater hydrology of the area is generally divided into two water-bearing units: the unconsolidated glacial deposits and the bedrock. The base obtains its drinking water supply from the glacial aquifer.

Groundwater at the base varies from surface level to over 100 feet, depending on topography. The two primary water supply wells extract water from the lower water-bearing glacial unit, at approximately 140 feet. Water levels in other base wells (e.g., monitoring wells) are somewhat deeper; the depth to the water table is relative to the elevation of the site (Engineering-Science, 1992). Historical data from the base have shown no substantial change in groundwater levels since two wells were installed in 1959, indicating that the aquifer supply has been adequate for water demands. The location of wells is important for water supply; some wells have produced little or no water (U.S. Geological Survey, 1987). The groundwater at the base generally flows north toward Lake Superior.

The groundwater in glacial deposits at the base is identified as a single aquifer in the western part of the base, and as two aquifers in the eastern part of the base (U.S. Geological Survey, 1987). The two eastern aquifers consist of an upper, unconfined aquifer separated by a till layer from a lower, confined aquifer.

Limited information on groundwater in bedrock under the base is available. In general, the two geological units underlying the base are Cambrian and

Precambrian sedimentary rocks that have low to moderate quantities of available water; the Precambrian metamorphic rocks contain little or no water.

Beginning in the late 1980s, the lakes and ponds southeast of K. I. Sawyer AFB have been experiencing lower water levels. The cause of the lower lake levels is unknown, but three areas were investigated by the USGS. The possible causes investigated included cumulative drought conditions; use of two K. I. Sawyer AFB domestic use water wells (Wells No. 9 and No. 10) near the McDonald Elementary School that were installed in 1989; or a combination of the drought and K. I. Sawyer AFB wells. The USGS water depletion survey focused on Martin, Sporley, Engman, and Provost lakes, which are southeast of the base. The results of the statistical analyses and groundwater flow modeling were inconclusive. The statistical analyses indicate water levels quickly rise in response to precipitation, but provide no evidence to suggest that levels change in response to groundwater withdrawal at K. I. Sawyer AFB. Groundwater flow model results suggest that water levels in the lakes may decline as a result of groundwater withdrawals or reduction in recharge (Weaver et al., 1995).

3.4.2.3 Water Quality. Recent water quality data from the base and older data from published sources (Doonan and VanAlstine, 1982; Grannemann, 1979; Grannemann, 1984; Huffman, 1986; Twenter, 1981; Wiitala et al., 1967) indicate that water from glacial deposits is good to satisfactory, if somewhat hard. Water from bedrock is harder. Iron content may be up to 5.0 mg/l in both sources.

Drinking water samples from the base water supply system have shown no levels of contaminants exceeding Michigan or U.S. EPA drinking water standards. IRP studies (Section 3.3) have identified some groundwater contamination near one drinking water supply well, although no drinking water analyses have identified any contamination. The contamination was found at a relatively shallow level (the well pumps water from deeper in the aquifer). As a safety precaution, this well is normally closed, and is only used during peak demand periods.

The base has several septic tanks; however, all but one are back-up systems for lift stations on the sewer system. The only septic tank in regular use is located at the Main Gate Visitor's Center, and its volume of use is low. As a result, septic tanks on base have minimal effect on water quality.

3.4.3 Air Quality

Air quality in a given location is described by the concentration of various pollutants in the atmosphere, generally expressed in units of ppm or $\mu g/m^3$. Air quality is determined by the type and amount of pollutants emitted into the atmosphere, the size and topography of the air basin, and the prevailing

meteorological conditions. The significance of a pollutant concentration is determined by comparing it to federal and state ambient air quality standards. These standards represent the maximum allowable atmospheric concentrations that may occur and still protect public health and welfare, with a reasonable margin of safety. The federal standards are established by the U.S. EPA and termed the National Ambient Air Quality Standards (NAAQS). The state of Michigan has adopted the NAAQS as their representative air quality standards. The NAAQS are presented in Table 3.4-2.

Table 3.4-2. National and Michigan Ambient Air Quality Standards

Pollutant	Averaging Time	National/Michigan Standards[a]	
		Primary[b,c]	Secondary[b,d]
Ozone	1-Hour	0.12 ppm (235 $\mu g/m^3$)	Same as Primary Standard
Nitrogen dioxide	Annual	0.053 ppm (100 $\mu g/m^3$)	Same as Primary Standard
Carbon monoxide	8-Hour	9 ppm (10,000 $\mu g/m^3$)	---
	1-Hour	35 ppm (40,000 $\mu g/m^3$)	---
Sulfur dioxide	Annual	80 $\mu g/m^3$ (0.03 ppm)	---
	24-Hour	365 $\mu g/m^3$ (0.14 ppm)	---
	3-Hour	---	1,300 $\mu g/m^3$ (0.5 ppm)
PM_{10}	Annual	50 $\mu g/m^3$[e]	Same as Primary Standard
	24-Hour	150 $\mu g/m^3$	Same as Primary Standard
Lead	Quarterly	1.5 $\mu g/m^3$	Same as Primary Standard

Notes: (a) Standards, other than those for ozone and those based on annual averages or arithmetic means, are not to be exceeded more than once per year. The ozone standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above the standard is equal to or less than one.

(b) Concentrations are expressed first in the units in which they were promulgated. Equivalent units given in parentheses are based upon on a reference temperature of 25 degrees Centigrade and a reference pressure of 760 millimeters of mercury (1,013.2 millibar); ppm in this table refers to ppm by volume, or micromoles of pollutant per mole of gas.

(c) Primary Standards: The levels of air quality necessary, with an adequate margin of safety, to protect public health.

(d) Secondary Standards: The levels of air quality necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant.

(e) Calculated as arithmetic mean.

$\mu g/m^3$ = micrograms per cubic meter

PM_{10} = particulate matter equal to or less than 10 microns in diameter

ppm = parts per million

Source: Clean Air Act, Title 42 U.S. Code Sections 7401-7671

The main pollutants of concern are ozone (O_3), carbon monoxide (CO), nitrogen oxides (NO_x), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), and particulate matter equal to or less than 10 microns in diameter (PM_{10}). NO_x include all oxide species of nitrogen. NO_x are of concern because of their potential contribution to ozone formation. Only that portion of total NO_x that is measurable as NO_2 is subject to the NAAQS. The previous NAAQS for particulate matter were based upon total suspended particulate (TSP) levels; they were replaced in 1987 by ambient standards based only on the PM_{10} fraction of TSP.

Lead is not addressed in this EIS because there are no known lead emission sources included in the reuse alternatives. Lead concentrations are monitored in a number of high population density areas throughout the United States, and all sites meet the quarterly primary and secondary standard of 1.5 $\mu g/m^3$.

The existing air quality of the affected environment is defined by air quality data and emissions information. Air quality data are obtained by examining air quality monitoring records collected by the MDNR-AQD from monitoring stations in the surrounding area. Information on pollutant concentrations measured for short-term (24 hours or less) and long-term (annual) averaging periods is extracted from the monitoring station data in order to characterize the existing air quality background of the area. Emission inventory information for the affected environment was obtained from the MDNR-AQD and from K. I. Sawyer AFB. Inventory data are separated by pollutant and reported in tons per year in order to describe the baseline conditions of pollutant emissions in the area.

Identifying the ROI for an air quality assessment requires knowledge of the pollutant types, source emission rates and release parameters, the proximity relationships of project emission sources to other emission sources, and local and regional meteorological conditions. For inert pollutants (all pollutants other than ozone, its precursors, and NO_2), the ROI is generally limited to an area extending a few miles downwind from the source.

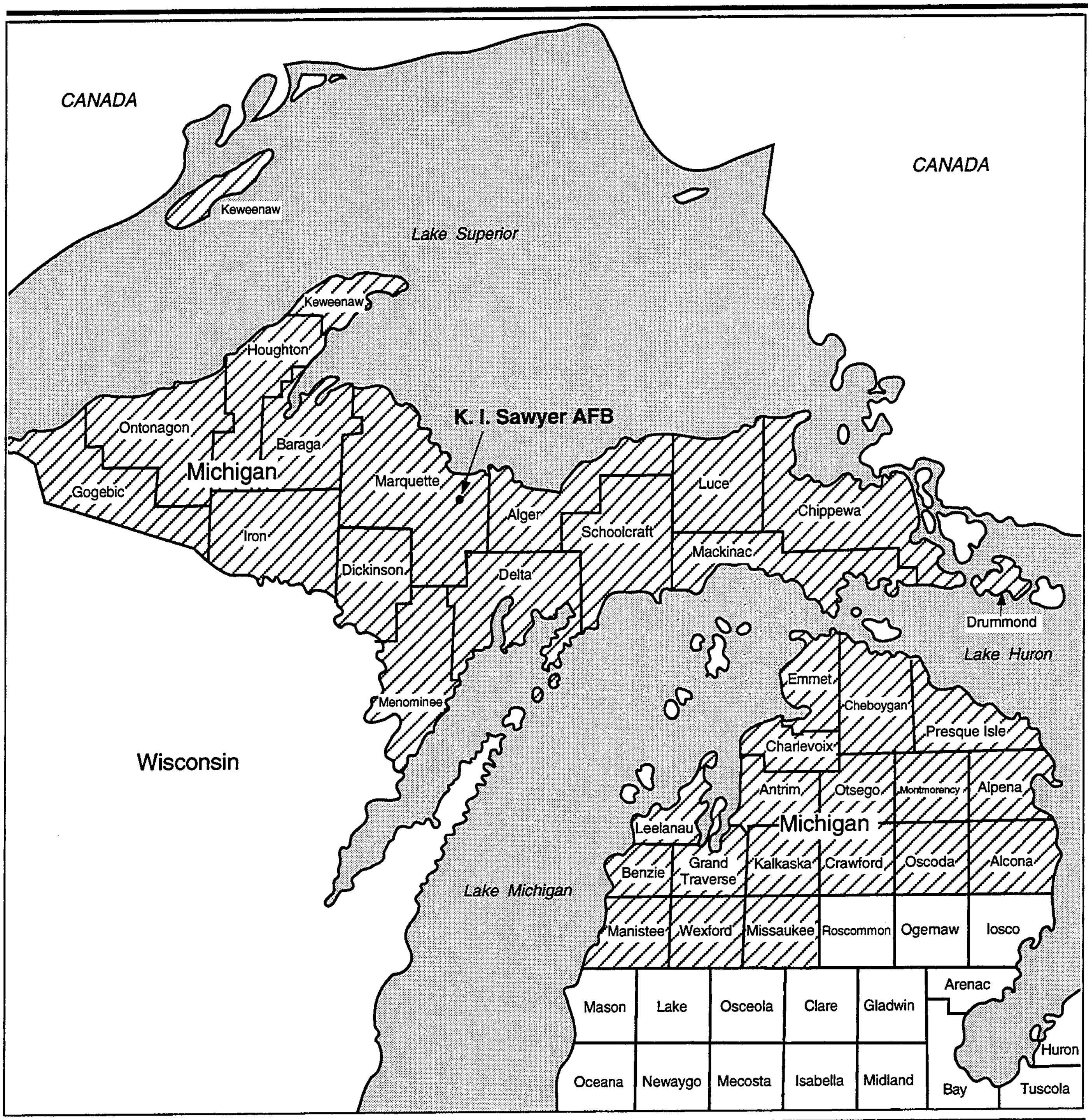
Ozone is a secondary pollutant formed in the atmosphere by photochemical reactions of previously emitted pollutants, or precursors. Ozone precursors are mainly VOCs in the form of hydrocarbons and NO_x. By U.S. EPA definition, VOCs are compounds containing carbon (excluding CO), carbon dioxide (CO_2), carbonic acid, metallic carbides, metallic carbonates, and ammonium carbonate. VOCs do not include methane or other nonreactive methane and ethane derivatives. NO_x is the designation given to the group of all oxygenated nitrogen species, including nitrous oxide (N_2O), nitric oxide (NO), NO_2, nitrogen trioxide (NO_3), nitrogen tetroxide (N_2O_4), nitric anhydride (N_2O_5), and nitrous anhydride (N_2O_3). Although all of these compounds can exist in air, only N_2O, NO, and NO_2 are present in any appreciable quantities.

The ROI for ozone may extend much farther downwind than the ROI for inert pollutants. In the presence of solar radiation, the maximum effect of precursor emissions on ozone levels usually occurs several hours after they are emitted and, therefore, many miles from the source. Ozone and its precursors transported from other regions can also combine with local emissions to produce high local ozone concentrations. Ozone concentrations are generally the highest during the summer months and coincide with periods of maximum solar radiation. Maximum ozone concentrations tend to be regionally distributed because precursor emissions are homogeneously dispersed in the atmosphere.

Like ozone, NO_2 emissions are also regionally distributed. NO_2 is formed primarily by the conversion of NO to NO_2 in the presence of oxygen (either during combustion or in the atmosphere). NO is produced by fuel combustion in both stationary and mobile sources, such as automobiles and aircraft. The amount of NO produced is dependent upon the combustion temperature and the rate of exhaust gas cooling. Higher temperatures and rapid cooling rates produce greater quantities of NO. Where higher NO concentrations and temperatures exist, some of the NO is immediately oxidized to NO_2. The amount of immediate NO_2 combustion generation generally varies from 0.5 to 10 percent of the NO present (U.S. EPA, 1971). The remaining unconverted NO is oxidized to NO_2 in the atmosphere primarily through photochemical secondary reactions initiated by the presence of sunlight. These photochemical reactions may take place hours after the initial NO release and many miles from the original source, dependent upon the prevailing meteorological conditions.

Air quality effects of ozone precursors and NO_2 emissions from the reuse-related construction and operational activities would include the existing airshed surrounding K. I. Sawyer AFB, i.e., the Upper Michigan Air Quality Control Region (Figure 3.4-3). However, due to the large size of the control region and the relative sparsity of emissions source data from this area, the analysis focuses on the effects within Marquette County. Reuse-related emissions of VOC, NO_x, and NO_2 are compared to emissions generated within Marquette County. Air quality effects of the inert pollutants (CO, SO_2, and PM_{10}) are limited to the more immediate area of reuse-related sources, such as K. I. Sawyer AFB.

The federal CAA, most recently amended in November 1990, dictates that project emission sources must comply with the air quality standards and regulations that have been established by federal, state, and county regulatory agencies. These standards and regulations focus on (1) the maximum allowable ambient pollutant concentrations resulting from project emissions, both separately and combined with other surrounding sources, and (2) the maximum allowable emissions from the project.



EXPLANATION

Upper Michigan Air Quality Control Region

Air Quality ROI

Figure 3.4-3

Prior to the 1990 CAA Amendments, federal regulation of hazardous air emissions was very limited. Section 112, as amended in 1990, requires U.S. EPA to regulate a greatly expanded list of hazardous air pollutants (HAPs). Additionally, U.S. EPA must publish a list of all categories and subcategories of emission sources of HAPs. After identifying and listing sources of HAPs, U.S. EPA must promulgate emission standards that are equivalent to maximum achievable control technology (MACT). By 2000, it is expected that final U.S. EPA regulations will control HAP emissions and require adoption of costly control measures for most medium- and large-sized sources of HAPs.

3.4.3.1 Regional Air Quality. K. I. Sawyer AFB is located on a plateau approximately 600 feet higher that the surrounding area, with Lake Superior 12 miles to the north and Lake Michigan 40 miles to the south. Weather conditions at K. I. Sawyer AFB are influenced by continental polar air masses and maritime effects from Lake Superior and Lake Michigan. The polar air masses cause a sharp reduction in temperature and the formation of clouds and some precipitation. Lake Superior and Lake Michigan increase the precipitation and moderate the temperature in the K. I. Sawyer AFB vicinity, resulting in cooler summer and warmer winter temperatures.

There are really only two seasons at K. I. Sawyer AFB: winter and summer. Springs and autumns are short transitional periods that are a combination of summer and winter. Summers at K. I. Sawyer AFB are short and mild. July is the warmest month, with an average high of 76°F and an average low of 53°F with an occasional drop to near freezing associated with the passage of a cold continental polar air mass. Winters are characterized by mostly cloudy skies with snow and sleet. January is the coldest month, with an average high temperature of 20°F and an average low of 3°F. Springs are highly variable and can start as early as April or as late as mid May. The number and severity of snow storms decreases, with summer-like weather between storms. Snowfall normally occurs from October to April and averages about 135 inches per year. Precipitation averages 34 inches per year and is evenly distributed throughout the year. Windspeed averages 6.8 knots and occurs primarily from the south-southwest.

According to U.S. EPA guidelines, an area with air quality better than the NAAQS is designated as being in attainment; areas with worse air quality are classified as nonattainment areas. An area is considered to be in attainment of an NAAQS (except for ozone and standards based upon annual average or annual arithmetic means) if the standards for the pollutant are not exceeded more than once per year. An area is considered to be in attainment for ozone if maximum hourly concentration exceeds the standard on no more than one day per calendar year. Pollutants in an area may be designated as unclassified when there is a lack of data for the U.S. EPA to form a basis of attainment status. An area designated as unclassified is assumed to be in attainment. Marquette County is designated by the U.S.

EPA as being in attainment of the NAAQS for all criteria pollutants (Michigan Department of Natural Resources, 1992).

New or modified major stationary sources in the area of K. I. Sawyer AFB would be subject to Prevention of Significant Deterioration (PSD) review to ensure that these sources are constructed without significant adverse deterioration of the clean air in the area. Emissions from any new or modified source must be controlled using best available control technology (BACT). The air quality impacts in combination with other PSD sources in the area must not exceed the maximum allowable incremental increases identified in Table 3.4-3. Certain national parks and wilderness areas are designated as Class I areas, where any appreciable deterioration in air quality is considered significant. Class II areas are those where moderate, well controlled industrial growth could be permitted. Class III areas allow for greater industrial development. The area surrounding K. I. Sawyer AFB is designated by the U.S. EPA as Class II. The Seney National Wildlife Refuge, a Class I area, is 55 miles to the east of K. I. Sawyer AFB.

Table 3.4-3. Maximum Allowable Pollutant Concentration Increases under PSD Regulations

Pollutant	Averaging Time	Maximum Allowable Increment ($\mu g/m^3$) Class I	Class II	Class III
Nitrogen dioxide	Annual	2.5	25	50
Sulfur dioxide	Annual	2	20	40
	24-hour	5	91	182
	3-hour	25	512	700
PM_{10}	Annual	4	17	34
	24-hour	8	30	60

Note: Class I areas are regions in which the air quality is intended to be kept pristine, such as national parks and wilderness areas. All other lands are initially designated Class II. Individual states have the authority to redesignate Class II lands as Class III to allow maximum industrial use.
$\mu g/m^3$ = micrograms per cubic meter
PM_{10} = particulate matter equal to or less than 10 microns in diameter
PSD = Prevention of Significant Deterioration

Source: 40 Code of Federal Regulations Parts 51 and 52, as revised June 3, 1993.

In addition to the requirements for PSD review, Title V of the CAA now requires a permit for sources with the following characteristics:

- Potential to emit 10 tons or more of a single HAP in a 1-year period
- Potential to emit 25 tons or more of HAPs in a 1-year period

- Potential to emit 100 tons or more of any criteria pollutant in a 1 year period
- Required to meet New Source Performance Standards
- Located in a nonattainment area.

The permitting authority must notify an adjoining state if one of the above sources is within 50 miles of that state or could affect the air quality of that state. The affected states then have the opportunity to make recommendations concerning the terms and conditions of the permit that would be issued to the source.

There are numerous monitoring stations around K. I. Sawyer AFB; however, ambient air quality is not measured within the boundaries of the base. The nearest PM_{10} monitoring stations, operated by the Wisconsin Electric Power Company, are located 12 miles north of K. I. Sawyer AFB. The Champion International Mill operates two air quality monitoring stations (Champion 1 and 2) in Dickinson County, approximately 47 miles southwest of K. I. Sawyer AFB. The Mead Paper Company operates two monitoring stations (CR 414 and 444). CR 414 is approximately 40 miles south-southeast of K. I. Sawyer AFB while CR 444 is approximately 26 miles east-southeast of the base. The maximum concentrations of the pollutants measured at these stations are presented in Table 3.4-4. None of the measured ambient conditions exceeded the NAAQS.

Preclosure Reference. Preclosure pollutant concentrations due to aircraft emissions in the immediate area of the base runways were estimated with the Emission and Dispersion Modeling System (EDMS) (Segal, 1988a, 1988b, 1991), a U.S. EPA-approved air dispersion model. EDMS was developed jointly by the FAA and the Air Force specifically for the purpose of generating airport and air base emission inventories and for calculating the concentrations caused by these emissions as they disperse downwind. The EDMS model uses U.S. EPA aircraft emission factors and information on peak and annual landing and takeoff cycles to produce an emissions inventory report for aircraft operations.

The results of the EDMS modeling for preclosure conditions at K. I. Sawyer AFB are provided in Table 3.4-5. The values in Table 3.4-5 represent the maximum concentrations, which occurred in the vicinity of the runways as a result of civilian and military aircraft operations, during 1992. The sum of all aircraft-related pollutant concentrations plus background concentrations is less than the applicable standards, except for PM_{10}, which exceeds the 24-hour NAAQS.

Closure Baseline. It can be reasonably assumed that pollutant concentrations in the region surrounding K. I. Sawyer AFB at base closure

Table 3.4-4. Existing Air Quality in Area around K. I. Sawyer AFB

Pollutant/Station	Averaging Time	Maximum Concentration by Year[a] ppm ($\mu g/m^3$) 1990	1991	1992
Ozone				
CR 444	1-Hour	ND	ND	0.114 (226.9)
Champion Site 1		0.087 (173.1)	0.104 (207.0)	0.091 (181.1)
Champion Site 2		0.086 (171.1)	0.083 (165.2)	0.092 (183.1)
Nitrogen Dioxide				
Champion Site 1	Annual	0.007 (13.4)	0.007 (13.4)	0.007 (13.4)
Champion Site 2		0.005 (9.6)	0.005 (9.6)	0.006 (11.5)
Carbon Monoxide				
	8-Hour	ND	ND	ND
	1-Hour	ND	ND	ND
Sulfur Dioxide				
CR 414	Annual	0.0083 (22)	0.009 (24)	0.0019 (5)
Champion Site 1		0.0034 (9)	0.0034 (9)	0.0034 (9)
Champion Site 2		0.0034 (9)	0.0034 (9)	0.0034 (9)
CR 414	24-Hour	0.153 (405)	0.130 (344)	0.012 (32)
Champion Site 1		0.014 (36)	0.011 (28)	0.009 (24)
Champion Site 2		0.008 (21)	0.009 (23)	0.008 (20)
CR 414	3-Hour	0.336 (891)	0.389 (1,031)	0.079 (210)
Champion Site 1		0.021 (56)	0.020 (54)	0.022 (57)
Champion Site 2		0.022 (58)	0.041 (108)	0.018 (49)
PM_{10}[b]				
Presque Isle	Annual (Arithmetic)	13	14	10
Northside, Lakeshore		16	15	12
Lakeshore Blvd 1		16	17	12
Lakeshore Blvd 2		13	14	9
Presque Isle	24-Hour	61	103	29
Northside, Lakeshore		78	134	53
Lakeshore Blvd 1		64	134	50
Lakeshore Blvd 2		61	114	27

Notes: (a) The CR 414 and CR 444 monitoring sites are located in Delta County, while the Champion Site 1 and Site 2 monitoring sites are located in Dickinson County. The PM_{10} monitoring sites are located 12 miles north of K. I. Sawyer AFB in the city of Marquette.
(b) PM_{10} concentrations are presented in units of $\mu g/m^3$ only.
$\mu g/m^3$ = micrograms per cubic meter
ND = no data
PM_{10} = particulate matter equal to or less than 10 microns in diameter
ppm = parts per million

Table 3.4-5. Air Quality Modeling Results for Preclosure Conditions in the Vicinity of the Runways at K. I. Sawyer AFB ($\mu g/m^3$)

Pollutant	Averaging Time	Maximum Impact[a]	Background Concentration[b]	NAAQS
Carbon monoxide	8-hour	310.0	5,000.0	10,000
	1-hour	443.0	20,000.0	40,000
Sulfur dioxide	Annual	3.6	11.7	80
	24-hour	14.6	103.7	365
	3-hour	32.8	279.3	1,300
PM_{10}	Annual	32.1	13	50
	24-hour	128.4	76	150

Notes: (a) Maximum impact in all cases occurred at a receptor located 700 meters south of the south end of the runway.
(b) Background concentrations assumed to equal the mean of maximum concentrations measured during the period from 1990-1992 (refer to Table 3.4-4) except for carbon monoxide. The background carbon monoxide concentration was assumed to be equal to half of the NAAQS.

$\mu g/m^3$ = micrograms per cubic meter
NAAQS = National Ambient Air Quality Standards
PM_{10} = particulate matter equal to or less than 10 microns in diameter

would be less than concentrations experienced under preclosure conditions due to the implementation of regional air emission control measures and the reduction of sources. Pollutant concentrations in the area of the base itself would be lower than the preclosure levels due to the reduction or elimination of numerous emission sources associated with normal base activities (e.g., all Air Force aircraft and aerospace ground activities would be eliminated). The closure would also reduce the number of motor vehicles operating in the surrounding area. Emissions associated with military vehicles would be eliminated, with the exception of those vehicles associated with the OL and caretaker activities.

3.4.3.2 Air Pollutant Emission Sources

Preclosure Reference. The K. I. Sawyer AFB and Marquette County emissions inventories representative of preclosure conditions are presented in Table 3.4-6. The base inventory information is for 1992. The most recent point source emission inventory representative of preclosure conditions in Marquette County was completed in 1992. The most recent area and mobile source information for Marquette County is for 1990. The base emissions presented in Table 3.4-6 are based on inventory calculations for direct sources associated with the base. The primary direct emission sources include aircraft flying operations, aerospace ground equipment (AGE), aircraft ground operations, heating and power production, and government-owned vehicles.

Table 3.4-6. **1992 Preclosure Emissions Inventory for K. I. Sawyer AFB (tons per day)**

Source	NO_x	CO	SO_2	PM_{10}	VOCs
Aircraft flying operations[a]					
Military	0.340	1.757	0.037	0.413	1.249
Civilian	0.001	0.010	0.000	0.000	0.001
Aircraft ground operations[b]					
Military	0.251	1.196	0.026	0.027	0.771
Aerospace ground equipment[c]	0.105	0.225	0.004	0.006	0.015
Heating and power production[d]	0.190	0.189	0.342	0.001	0.004
Motor vehicles[e]	0.034	0.161	--	--	0.015
Surface coating[f]	--	--	--	--	0.010
Fuel evaporation losses[g]	--	--	--	--	0.129
Solvent degreasing[h]	--	--	--	--	0.009
Base Total	0.921	3.538	0.409	0.447	2.203

Notes: (a) Aircraft flying operation emissions were estimated using the Emission and Dispersion Modeling System model and 1992 aircraft operation data from K. I. Sawyer AFB.

(b) Aircraft ground operation emissions were estimated using the methods of Fagin (1988) and 1992 runup/testing data from K. I. Sawyer AFB.

(c) Aerospace ground equipment emissions were estimated using average aerospace ground equipment emission factor information from Loring and Wurtsmith AFBs and 1992 data on B-52, KC-135, and T-37 aircraft operations at K. I. Sawyer AFB.

(d) Heating and power production emissions were estimated using emission factors from U.S. Environmental Protection Agency's AP-42 document and 1992 fuel use data from the K. I. Sawyer AFB heat plant.

(e) Motor vehicle emissions were estimated using emission factors from the U.S. Environmental Protection Agency's MOBILE 5A program and 1992 fuel use data for government-owned vehicles at K. I. Sawyer AFB. Mileage was estimated using the assumption of 20 miles per gallon for gasoline-fueled vehicles and 10 miles per gallon for diesel-fueled vehicles.

(f) Surface coating emissions were estimated using the methods of Fagin (1988) and 1992 paint, primer, and thinner use data from K. I. Sawyer AFB.

(g) Fuel evaporation losses were estimated using the U.S. Environmental Protection Agency's TANKS2 program (breathing losses) and AP-42 emission factors (filling, evaporation, and spillage losses) and 1992 fuel use and storage data from K. I. Sawyer AFB.

(h) Solvent degreasing emissions were estimated using the methods of Fagin (1988) and 1992 solvent use data from K. I. Sawyer AFB.

CO = carbon monoxide
NO_x = nitrogen oxides
PM_{10} = particulate matter equal to or less than 10 microns in diameter
SO_2 = sulfur dioxide
VOCs = volatile organic compounds

Fuel evaporation losses and surface coatings also contribute substantially to the amount of VOC emissions released at K. I. Sawyer AFB.

The only point source emissions reported for Marquette County are for permitted major stationary sources within the county (Michigan Department of Natural Resources, 1993). Area and mobile source emissions data are only available from the 1990 Interim Inventory of the U.S. EPA Graphical

Aerometric Data System (EGADS). Data were extracted from EGADS by use of the Base Realignment and Closure Air Emission Factor Calculator developed to support air emission calculations for the base realignment and closure environmental impact process. Emissions from Marquette County point sources, not including K. I. Sawyer AFB point sources, are as follows: NO_x 1,557.3 tons per day, CO 30.5 tons per day, SO_2 1,093.4 tons per day, PM_{10} 171.5 tons per day, and VOCs 6.2 tons per day. Emissions from Marquette County area and mobile sources are: NO_x 1.2 tons per day, CO 21.3 tons per day, and VOCs 6.4 tons per day. Area and mobile source emissions of SO_2 and PM_{10} were not reported in EGADS.

Although the K. I. Sawyer AFB emission inventory shown in Table 3.4-6 provides a preclosure reference to the primary base-related emissions, the inventory does not consider off-base air emissions from employee vehicle commuting sources related to K. I. Sawyer AFB. In addition, the inventory data presented in Table 3.4-6 are difficult to compare to emissions from future reuse scenarios that require calculation by different forecasting methods. Therefore, Table 3.4-7 provides the total base-related emissions associated with both direct sources and employee vehicle sources using the same forecasting methods as applied to the reuse alternatives. Appendix I describes the consistent methodology used to recalculate K. I. Sawyer AFB preclosure emissions for direct comparison with projected reuse-related emissions.

Table 3.4-7. Total Base-Related Emissions from Direct and Indirect Sources (tons per day)

	NO_x	CO	SO_2	PM_{10}	VOCs
Preclosure (1992)	1.23	5.86	0.41	0.45	2.42
Closure (1995)	0.041	0.062	0.068	0.000	0.003

CO = carbon monoxide
NO_x = nitrogen oxides
PM_{10} = particulate matter equal to or less than 10 microns in diameter
SO_2 = sulfur dioxide
VOCs = volatile organic compounds

Closure Baseline. The base-related emissions for K. I. Sawyer AFB at base closure in 1995 were estimated by calculating the direct emissions and employee vehicle emissions associated with OL and caretaker activities (see Table 3.4-7). The reduction in base-related emissions from preclosure conditions reflects the loss of Air Force sources due to reduced on-base activities, reduced heating and power requirements, and the reduction in population associated with K. I. Sawyer AFB at the time of closure.

3.4.4 Noise

The ROI for noise sources at K. I. Sawyer AFB is defined using FAA-developed land use compatibility guidelines. The area most affected by noise due to the base disposal and reuse is limited to the area in and around the base within the DNL 65 dB contour. The ROI includes, but is not limited to, the communities of Marquette, Sands, Harvey, Gwinn, Little Lake, and Skandia.

Noise is usually defined as sound that is undesirable because it interferes with speech communication and hearing, is intense enough to damage hearing, or is otherwise annoying. The characteristics of sound include parameters such as amplitude, frequency, and duration. Sound can vary over an extremely large range of amplitudes. The dB, a logarithmic unit that accounts for the large variations in amplitude, is the accepted standard unit for the measurement of sound. Table 3.4-8 presents examples of typical sound levels. Different sounds may have different frequency contents. When measuring sound to determine its effects on a human population, A-weighted sound levels (dB) are typically used to account for the frequency response of the human ear. A-weighted sound levels represent adjusted sound levels. The adjustments established by the American National Standards Institute (1983) are applied to the frequency content of sound.

Noise levels often change with time; therefore, to compare levels over different time periods, several descriptors were developed that take into account this time-varying nature. These descriptors are used to assess and correlate the various effects of noise on man and animals, including land-use compatibility, sleep interference, annoyance, hearing loss, speech interference, and startle effects.

DNL was developed to evaluate the total community noise environment. DNL (sometimes abbreviated as L_{dn}) is the average A-weighted acoustical energy during a 24-hour period with a 10 dB adjustment added to the nighttime levels (between 10:00 p.m. and 7:00 a.m.). This adjustment is an effort to account for the increased sensitivity to nighttime noise events. DNL was endorsed by the U.S. EPA for use by federal agencies and has been adopted by HUD, FAA, and DOD.

DNL is an accepted unit for quantifying human annoyance to general environmental noise, which includes aircraft noise. The Federal Interagency Committee on Urban Noise developed land-use compatibility guidelines for noise in terms of DNL (U.S. DOT, 1980). Table 3.4-9 provides FAA-recommended DNL ranges for various land use categories based upon the committee's guidelines. The FAA guidelines were used in this study to determine noise impacts (FAA, 1989b).

Table 3.4-8. Comparative Sound Levels

Common Outdoor Sound Levels	Sound Level (dB)	Common Indoor Sound Levels
	110	Rock Band
Jet Flyover at 1,000 feet		
	100	Inside Subway Train (New York)
Gas Lawnmower at 3 feet		
	90	
Diesel Truck at 50 feet		Food Blender at 3 feet
Noisy Urban Daytime		Garbage Disposal at 3 feet
	80	
		Shouting at 3 feet
Gas Lawnmower at 100 feet		Vacuum Cleaner at 10 feet
	70	
Commercial Area		Normal Speech at 3 feet
Heavy Traffic at 300 feet		
	60	
		Large Business Office
		Dishwasher Next Room
	50	
Quiet Urban Nighttime		Small Theater, Large Conference Room (Background)
	40	
Quiet Suburban Nighttime		Library
	30	Bedroom at Night
Quiet Rural Nighttime		Concert Hall (Background)
	20	
		Broadcast and Recording Studio
	10	
		Threshold of Hearing
	0	

Table 3.4-9. Land Use Compatibility with Yearly Day-Night Average Sound Levels
Page 1 of 2

Land Use	Below 65	65-70	70-75	75-80	80-85	Over 85
	Yearly Day-Night Average Sound Level (DNL) in Decibels					
Residential						
Residential, other than mobile homes and transient lodgings	Y	N[a]	N[a]	N	N	N
Mobile home parks	Y	N	N	N	N	N
Transient lodgings	Y	N[a]	N[a]	N[a]	N	N
Public Use						
Schools	Y	N[a]	N[a]	N	N	N
Hospitals and nursing homes	Y	25	30	N	N	N
Churches, auditoriums, and concert halls	Y	25	30	N	N	N
Governmental services	Y	Y	25	30	N	N
Transportation	Y	Y	Y[b]	Y[c]	Y[d]	Y[d]
Parking	Y	Y	Y[b]	Y[c]	Y[d]	N
Commercial Use						
Office, business, and professional	Y	Y	25	30	N	N
Wholesale and retail-building materials, hardware, and farm equipment	Y	Y	Y[b]	Y[c]	Y[d]	N
Retail trade-general	Y	Y	25	30	N	N
Utilities	Y	Y	Y[b]	Y[c]	Y[d]	N
Communication	Y	Y	25	30	N	N
Manufacturing and Production						
Manufacturing, general	Y	Y	Y[b]	Y[c]	Y[d]	N
Photographic and optical	Y	Y	25	30	N	N
Agriculture (except livestock) and forestry	Y	Y[f]	Y[g]	Y[h]	Y[h]	Y[h]
Livestock, farming and breeding	Y	Y[f]	Y[g]	N	N	N
Mining and fishing, resource production and extraction	Y	Y	Y	Y	Y	Y
Recreational						
Outdoor sports arenas and spectator sports	Y	Y[e]	Y[e]	N	N	N
Outdoor music shells, amphitheaters	Y	N	N	N	N	N
Nature exhibits and zoos	Y	Y	N	N	N	N
Amusement parks, resorts, and camps	Y	Y	Y	N	N	N
Golf courses, riding stables, and water recreation	Y	Y	25	30	N	N

Letters in parentheses refer to notes (see next page). The designations contained in this table do not constitute a federal determination that any use of land covered by the program is acceptable or unacceptable under federal, state, or local law. The responsibility for determining the acceptable and permissible land uses and the relationship between specific properties and specific noise contours rests with the local authorities. FAA determinations under Part 150 are not intended to substitute federally determined land uses for those determined to be appropriate by local authorities in response to locally determined needs and values in achieving noise compatible land uses.

Key

Y (Yes)	Land use and related structures compatible without restrictions.
N (No)	Land use and related structures are not compatible and should be prohibited.
25, 30, or 35	Land use and related structures generally compatible; measures to achieve Noise Level Reduction (NLR) of 25, 30, or 35 dB must be incorporated into design and construction of structure.

Table 3.4-9. Land Use Compatibility with Yearly Day-Night Average Sound Levels
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Notes

(a) Where the community determines that residential or school uses must be allowed, measures to achieve outdoor to indoor NLR of at least 25 dB and 30 dB should be incorporated into building codes and be considered in individual approvals. Normal residential construction can be expected to provide an NLR of 20 dB, thus, the reduction requirements are often stated as 5, 10, or 15 dB over standard construction and normally assume mechanical ventilation and closed windows year round. However, the use of NLR criteria will not eliminate outdoor noise problems.

(b) Measures to achieve an NLR of 25 dB must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise-sensitive areas, or where the normal noise level is low.

(c) Measures to achieve an NLR of 30 dB must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise-sensitive areas, or where the normal noise level is low.

(d) Measures to achieve an NLR of 35 dB must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise-sensitive areas, or where the normal noise level is low.

(e) Land use compatible, provided special sound reinforcement systems are installed.

(f) Residential buildings require an NLR of 25 dB.

(g) Residential buildings require an NLR of 30 dB.

(h) Residential buildings not permitted.

Source: FAA, 1989b.

DNL is used in this report because it is the noise descriptor recognized by the FAA and Air Force for airfield environments. DNL is sometimes supplemented with other metrics, primarily the equivalent sound level (L_{eq}). The L_{eq} is the equivalent, steady-state level that would contain the same acoustical energy as the time-varying level during the same time interval. Occasionally, the sound exposure level (SEL) is used to supplement DNL, especially where sleep disturbance is a concern. The SEL value represents the A-weighted sound level integrated over the entire duration of the noise event and referenced to a duration of 1 second. When an event lasts longer than 1 second, the SEL value will be higher than the highest sound level during the event. SEL is used in this report when discussing sleep disturbance effects.

Appendix J provides additional information about the measurement and prediction of noise. This appendix also provides more information on the units used in describing noise, as well as information about the effects of noise, such as annoyance, sleep and speech interference, health effects, and effects on animals.

3.4.4.1 Existing Noise Levels. Typical noise sources in and around airfields usually include aircraft, surface traffic, and other human activities. Military aircraft operations and surface traffic on local streets and highways are the existing primary sources of noise in the vicinity of K. I. Sawyer AFB. In airport analyses, areas with DNLs above 65 dB are often considered in land-use compatibility planning and impact assessment; therefore, the contours of DNLs greater than 65 dB are of particular interest. Contours above DNL 65 dB are modeled and analyzed in 5-dB intervals.

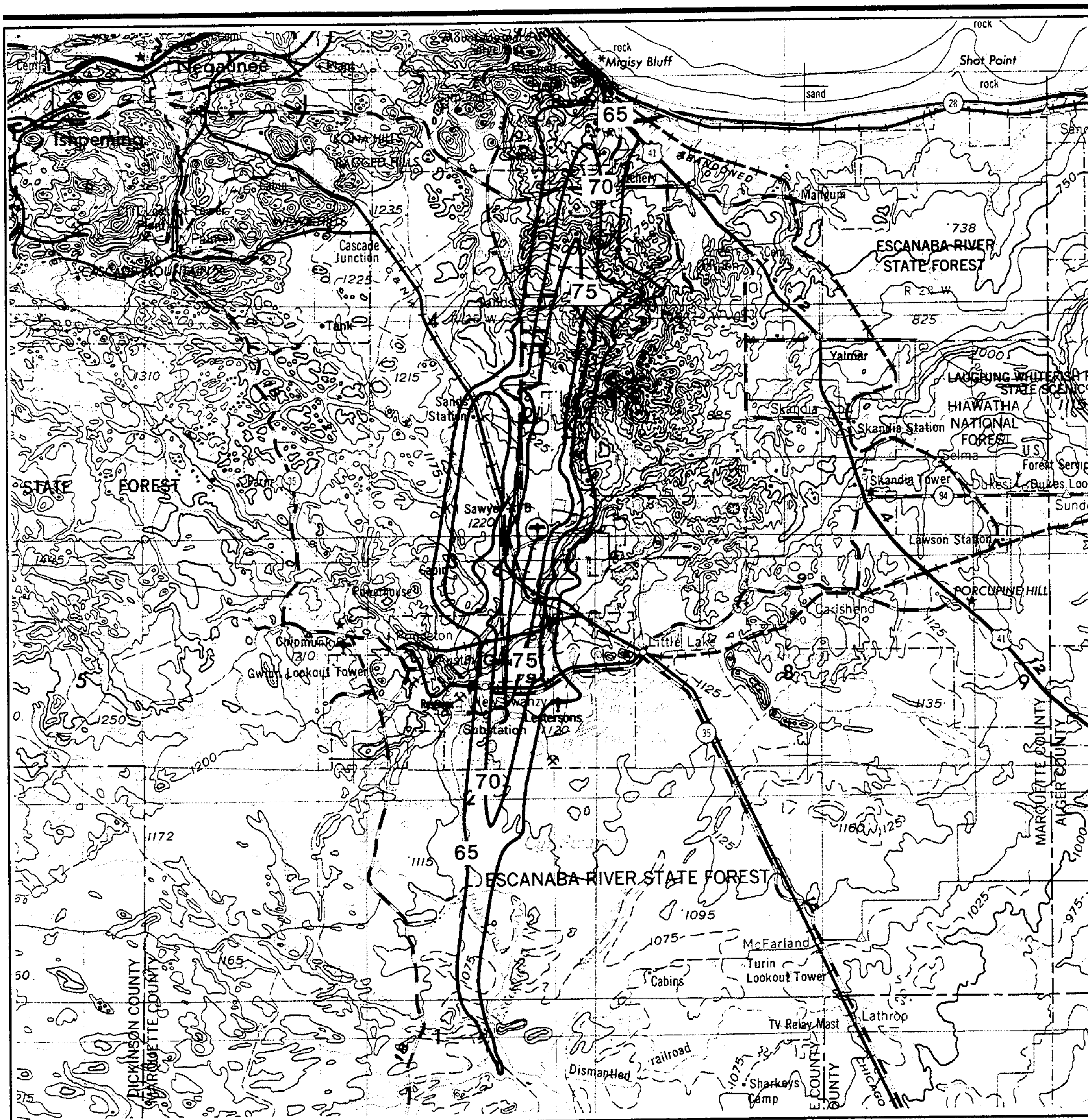
Preclosure Reference. Aircraft noise at K. I. Sawyer AFB occurs during aircraft engine warmup, maintenance and testing, taxiings, takeoffs, approaches, and landings. Noise contours for preclosure aircraft operations (see Table 3.2-6) were modeled using information on aircraft types; runway use; runup locations; takeoff and landing flight tracks; aircraft altitude, speeds, and engine power settings; and number of daytime (7:00 a.m. to 10:00 p.m.) and nighttime (10:00 p.m. to 7:00 a.m.) operations. The noise contours for 1993 are shown in Figure 3.4-4. Only those contours equal to or above DNL 65 dB are shown. Approximately 27,089 acres and 3,424 residents were exposed to DNL 65 dB or greater.

Surface vehicle traffic noise levels for roadways in the vicinity of K. I. Sawyer AFB were analyzed using the Federal Highway Administration's Highway Noise Model (Federal Highway Administration, 1978). This model incorporates vehicle mix, traffic volume projections, and speed to generate DNL. The noise levels are then presented as a function of distance from the centerline of the nearest road. The results of the modeling for surface traffic are presented in Table 3.4-10. At preclosure, 153 people would reside in areas exposed to surface traffic noise levels of DNL 65 dB or greater. The actual distances to the DNLs may be less than those presented in the table because the screening effects of intervening buildings, terrain, and walls were not accounted for in the modeling.

Appendix J contains the data used in the surface traffic analysis. These data include AADTs, traffic mix, and speeds.

Closure Baseline. The projected noise levels for the closure baseline were calculated using the surface traffic projections at base closure (Appendix J). The results of the modeling for the roadways analyzed are presented in Table 3.4-10. At closure, 182 people would reside in areas exposed to surface traffic noise levels of DNL 65 dB or greater. Again, the actual distances to the DNLs may be less than those presented in the table because the model does not account for screening effects of intervening buildings, terrain, and walls.

At closure it is assumed that there would be no aircraft operations and, therefore, there would be no areas impacted by aircraft noise.



EXPLANATION

— 65 — DNL Noise Contour (in 5 dB intervals)

- - - - Base Boundary

0 4,500 9,000 18,000 Feet

Map Source: U.S. Geological Survey 1984.

Preclosure Aircraft Noise Contours

Figure 3.4-4

Table 3.4-10. Distance to DNL from Roadway Centerline for the Preclosure Reference and Closure Baseline

Roadway	Segment	Distance (feet) DNL 65dB	Number of Residents	Distance (feet) DNL 70dB	Number of Residents	Distance (feet) DNL 75dB	Number of Residents
Preclosure							
CR 462	Main Gate to CR 553	40	0	20	0	(a)	NA
CR 460	Gate 2 to CR 545	30	0	(a)	NA	(a)	NA
CR 460	CR 545 to U.S. 41	30	0	(a)	NA	(a)	NA
CR 480	West of CR 553	80	0	40	0	20	0
CR 480	CR 553 to U.S. 41	60	11	30	0	(a)	NA
CR 553	Marquette city limits to CR 480	80	3	40	0	20	0
CR 553	CR 480 to CR 462	80	33	40	0	20	0
CR 553	CR 462 to Southgate Drive	90	0	40	0	20	0
CR 553	Southgate Drive to SH 35	60	0	30	0	(a)	NA
CR 545	U.S. 41 to CR 460	20	0	(a)	NA	(a)	NA
CR 545	CR 460 to CR 456	(a)	NA	(a)	NA	(a)	NA
CR 456	SH 35 to CR 545	30	3	20	0	(a)	NA
CR 456	CR 545 to U.S. 41	20	0	(a)	NA	(a)	NA
U.S. 41	SH 28 to Skandia	90	100	40	3	20	0
U.S. 41	Skandia to SH 94	50	0	30	0	20	0
U.S. 41	SH 94 to CR 456	50	0	30	0	(a)	NA
SH 35	CR 553 to CR 456	40	0	20	0	(a)	NA
SH 35	CR 456 to Morbit Lake Access	20	0	(a)	NA	(a)	NA
Closure							
CR 462	Main Gate to CR 553	(a)	NA	(a)	NA	(a)	NA
CR 460	Gate 2 to CR 545	(a)	NA	(a)	NA	(a)	NA
CR 460	CR 545 to U.S. 41	30	0	(a)	NA	(a)	NA
CR 480	West of CR 553	80	0	40	0	20	0
CR 480	CR 553 to U.S. 41	60	11	30	0	(a)	NA
CR 553	Marquette city limits to CR 480	90	3	40	0	20	0
CR 553	CR 480 to CR 462	90	22	40	0	20	0
CR 553	CR 462 to Southgate Drive	100	0	50	0	20	0
CR 553	Southgate Drive to SH 35	70	0	30	0	(a)	NA
CR 545	U.S. 41 to CR 460	20	0	(a)	NA	(a)	NA
CR 545	CR 460 to CR 456	(a)	NA	(a)	NA	(a)	NA
CR 456	SH 35 to CR 545	30	3	20	0	(a)	NA
CR 456	CR 545 to U.S. 41	20	0	(a)	NA	(a)	NA
U.S. 41	SH 28 to Skandia	100	134	50	6	30	3
U.S. 41	Skandia to SH 94	60	0	30	0	20	0
U.S. 41	SH 94 to CR 456	50	0	30	0	(a)	NA
SH 35	CR 553 to CR 456	50	0	20	0	(a)	NA
SH 35	CR 456 to Morbit Lake Access	20	0	(a)	NA	(a)	NA

Note: (a) Contained within the roadway.
CR = County Road
dB = decibel
DNL = day-night average sound level
NA = not applicable
SH = State Highway
U.S.# = U.S. Highway

3.4.4.2 Noise-Sensitive Areas. The preclosure ROI for K. I. Sawyer AFB includes noise-sensitive receptors, such as residences and the base hospital, that are within the DNL 65 dB contour. The modeled contours (see Figure 3.4-4) indicate that there are approximately 27,089 acres containing 3,424 residents exposed to DNL 65 dB or greater. Approximately 133 of these residents, primarily in the Gwinn area, live within areas impacted by noise in the DNL 75-79 dB range (U.S. Air Force, 1993c). Section 3.2.3, Land Use and Aesthetics, describes land uses on and near the base.

3.4.5 Biological Resources

Biological resources include the native and introduced plants and animals in the project area. For discussion purposes, these are divided into vegetation, wildlife (including aquatic fauna), threatened and endangered species, and sensitive habitats.

K. I. Sawyer AFB is surrounded by forested land, much of it within the Escanaba River State Forest. Although approximately 35 percent of the base is forested, human activities have resulted in development of over half of the total base acreage to support military operations. Substantial portions of this developed area are maintained as lawns, athletic fields, and other landscaping, including a 168-acre golf course. Silver Lead Creek, which flows northeastward across the base, has associated riparian, wetland, and aquatic habitats, including Little Trout Lake.

The ROI used for discussion of biological resources is the base and the contiguous lands and surface waters. This includes the area within which potential impacts could occur and provides a basis for evaluating the level of impact. Information on the affected environment has been obtained through plans, maps, and reports on file with the base, informal consultation with state and federal agencies, literature review, a biological survey (June 1994), and surveys conducted by the Michigan Natural Features Inventory in 1993 and 1994. The surveys conducted by the biologist for the Michigan Natural Features Inventory included surveys for high quality natural communities and federally and state-listed plants and animals. On-base wetlands were identified by the U.S. Fish and Wildlife Service (USFWS) during fall 1993. Scientific names of species reported from K. I. Sawyer AFB, including those mentioned in the text, are provided in Appendix K.

3.4.5.1 Vegetation. The Upper Peninsula of Michigan is within the hemlock-white pine-northern hardwoods region of the eastern deciduous forest (Braun, 1950). Natural vegetation on lands surrounding and including K. I. Sawyer AFB is a mixture of forest types including pine communities on sand plains, northern hardwood communities in deeper soils, aspen communities in disturbed areas, and bogs and swamps in depressions and along the margins of streams.

K. I. Sawyer AFB covers approximately 4,923 acres, less than half of which is forested (Figure 3.4-5). No old growth forests are present on K. I. Sawyer AFB or the surrounding land (Koss, 1994). On-base forests are dominated by stands of jack pine, red pine, and aspen, and are managed for timber production and wildlife, especially white-tailed deer (U.S. Air Force, 1993d). These forests contain a low, continuous understory of late low blueberry, sand cherry, and bracken fern. Many of the jack pine forests on base have been cut and replanted in accordance with the K. I. Sawyer AFB Forest Management Plan (U.S. Air Force, 1993d). For this reason individual stands are generally of one age. Forest on state-owned land that surrounds the base is managed in accordance with the state of Michigan forest management plans and policy for managing state forest lands (Michigan Department of Natural Resources, 1991).

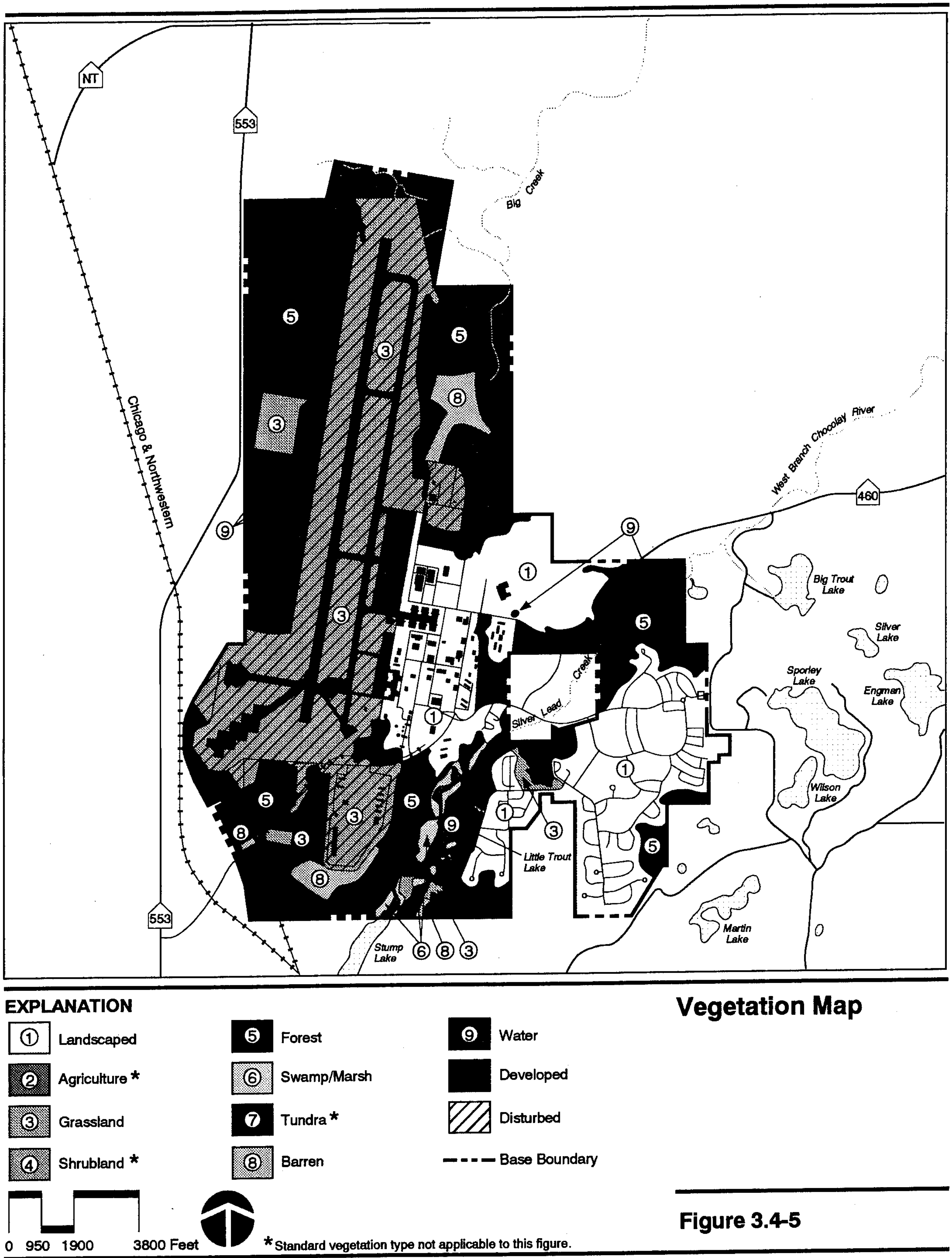
Northern hardwood forests occur on the far northern and northeastern part of the base. Dominant species include sugar maple, red oak, and paper birch. The understory is primarily saplings of the same species as are found in the overstory and low-growing herbs. Small pockets of aspen-dominated communities occur on previously disturbed sites.

Wooded swamps and bogs containing American larch and black spruce with a thick layer of sphagnum moss, Labrador tea, and pale laurel are found in low-lying areas and along the margins of slow-flowing streams on the eastern side of the base.

Over half of the total base area is maintained, landscaped, or developed. Some small stands of trees are present in and around the golf course and the housing area. These areas are mapped as landscaping because they are maintained similar to landscaped areas.

Grasslands on K. I. Sawyer AFB are present where forests have been cleared. Some of these areas, including approximately 240 acres of grassland adjacent to the runway, are mowed and maintained periodically (U.S. Air Force, 1991e). Other grassland areas are not maintained.

During the surveys conducted by the Michigan Natural Features Inventory, two state special concern plants (the fir clubmoss and James' monkey-flower) were discovered along Silver Lead Creek. The fir clubmoss was found in a moist borrow pit on a slope above Silver Lead Creek on the eastern portion of the base. Relatively few occurrences of this species have been documented in the western Upper Peninsula, and none have been previously identified in Marquette County. The James' monkey-flower was found in a very localized colony in a small portion of Silver Lead Creek, just inside the north base boundary. No previous records of the James' monkey-flower have been documented in the western Upper Peninsula. The dry-mesic (dry-moist) northern forest along the northeast portion of Silver Lead Creek provides the cool seepages required by this plant. The dry-mesic



Vegetation Map

Figure 3.4-5

northern forest has been classified by the Michigan Natural Features Inventory as a natural community.

3.4.5.2 Wildlife. Forest areas on K. I. Sawyer AFB are contiguous with surrounding forest lands and contain species typical of pine forests. Forest understory species, as well as lawns and landscape plantings, provide abundant habitat for songbirds on the base (U.S. Air Force, 1991d). Open areas along the runway are attractive to migratory waterfowl and sea gulls. Species reported on K. I. Sawyer AFB and species observed in the June field surveys are included in Appendix K.

The jack pine habitat has very little diversity and the understory does not provide large amounts of cover. Therefore, forested areas on the base provide only fair habitat for white-tailed deer, flying squirrels, foxes, bobcat, black bear, and cottontail rabbits. Ruffed and sharp-tailed grouse are found in grassland areas, especially along the runway. Wetlands and open water associated with Silver Lead Creek and Little Trout Lake constitute habitat for migratory waterfowl such as mallard, black duck, wood duck, and blue-winged teal. Habitat for amphibians and reptiles, including American toad, spring peeper, wood frog, spotted salamander, wood turtle, and smooth green snake is most prevalent along the Silver Lead Creek riparian corridor. A large number of native and introduced fish species occur on K. I. Sawyer AFB. Rainbow and brook trout occur in Silver Lead Creek, and rainbow trout are stocked in Little Trout Lake (U.S. Air Force, 1991d).

During the surveys conducted by the Michigan Natural Features Inventory, the frigga fritillary (state special concern) was recorded within a small bog near Little Trout Lake. The frigga fritillary is a butterfly that is confined to bog habitats in the Upper Peninsula. The small bog near Little Trout Lake is the only habitat on base that can support this butterfly.

3.4.5.3 Threatened and Endangered Species. A letter requesting a sensitive species list for the project area was sent to the USFWS as recommended by the federal Endangered Species Act. The MDNR was consulted for information on state rare and protected species occurring in the vicinity of K. I. Sawyer AFB. Agency responses are contained in Appendix M. The Michigan Natural Features Inventory conducted surveys for protected species during 1993 and 1994. No federally or state-listed as threatened or endangered species were discovered during these surveys, but three state-listed species of special concern were found. Two of these are plants (fir clubmoss and James' monkey-flower); the third is the frigga fritillary butterfly.

State- or federally listed sensitive species reported in the vicinity of K. I. Sawyer AFB are included in Table 3.4-11. Federally listed species that may be present in surrounding areas include the bald eagle (state- and federally listed as threatened), which has been observed foraging on base over Little

Table 3.4-11. Federal or State Sensitive Species Reported in the Vicinity of K. I. Sawyer AFB

Name	Status Federal	Status State	Habitat and Distribution
Narrow-leaved gentian (*Gentiana linearis*)		T	Occurs in bogs, wet meadows, and wet woods throughout the region, primarily in siliceous and granitic soils (Fernald, 1950). This species is known to occur in the vicinity of the base (Weise, 1993)
Fir clubmoss (*Huperzia selago*)		SC	Frequently occurs at periphery of sandy borrow pits, in ditches, lakeshore swales, wet scrapes, and conifer swamps; rarely on acidic, igneous rock or calcareous coast cliffs. Has been found along Silver Lead Creek
James' monkey-flower (*Mimulus glabratus* var. *jamesii*)		SC	Found in colonies primarily along stream edges, springs, and seeps. Has been found along Silver Lead Creek
Frigga fritillary (*Boloria frigga*)		SC	A butterfly that inhabits open, sedgy sphagnum bogs. Has been observed in the bog near Little Trout Lake
Bald eagle (*Haliaeetus leucocephalus*)	T	T	Nests along lakes and rivers around the base. Has been recorded foraging over Little Trout Lake
Kirtland's warbler (*Dendroica kirtlandii*)	E	E	Nests in dense stands of young jack pine in the Lower Peninsula. This species is not expected to breed on base
American peregrine falcon (*Falco peregrinus*)	E	E	This species has been reintroduced into Michigan. Normally found in open country such as grasslands, at river mouths, and along the shorelines of large bodies of water. Requires cliffs for nesting, therefore, an unlikely breeder on base (closest recorded breeding observed in Alger County, Pictured Rocks National Lakeshore)
Common loon (*Gavia immer*)		SC	Nests along shorelines of freshwater lakes or ponds. Has been recorded during summer months foraging on Little Trout Lake
Gray wolf (*Canis lupus*)	E	E	Wide-ranging species through densely vegetated forests. This species has been recorded in the vicinity of the base and could cross base boundaries

E = endangered
SC = special concern
T = threatened

Trout Lake and nests within 8 miles of the base; American peregrine falcon (state- and federally listed as endangered), which has not been reported on base but has been reintroduced in Alger County and could possibly forage within the vicinity of Little Trout Lake and Silver Lead Creek (Weise, 1994); gray wolf (state- and federally listed as endangered), which is known to be in the area, and although not recorded on base, could possibly cross base property within suitable habitat in some of the less disturbed forested areas surrounding the runway and the northern extent of Silver Lead Creek; and Kirtland's warbler (state- and federally listed as endangered), an extremely rare species, which is found in stands of young Jack pine. A single male Kirtland's warbler was observed singing in 1984 within 2 miles of the base, but this species has not been observed in the vicinity since then and is not expected on the base (Koss, 1994). State-listed species include the common loon (a state species of special concern), which has been reported on base in Little Trout Lake during the summer; and the narrow-leaved gentian (state-listed as threatened), which may be found in wet meadows, woodlands, and bogs on the base.

3.4.5.4 Sensitive Habitats. Sensitive habitats usually include wetlands, plant communities that are unusual or of limited distribution, and important seasonal use areas for wildlife (e.g., migration routes, breeding areas, crucial summer/winter habitat). The MDNR considers sensitive habitats in the vicinity of K. I. Sawyer AFB to include wetlands and open water habitats; ecologically critical and regionally uncommon forest types such as old-growth oak forests, or stands with abundant snags (large, dead trees); wintering habitats for deer; and mosaic habitats of forest and grasslands, wetlands, or open water that provide maximal habitat and wildlife diversity (Michigan Department of Natural Resources, 1991).

The only sensitive habitats that occur on K. I. Sawyer AFB are wetlands. Most of the wetland habitat on base is associated with Little Trout Lake and Silver Lead Creek. Little Trout Lake, which covers over 10 acres, is fed by Silver Lead Creek. During the summer, the lake, which is stocked with fish, is used as a recreation area and has a sandy beach, a picnic and day use area, and rental paddle boats and canoes. A small bog near Little Trout Lake supports the frigga fritillary butterfly, a Michigan species of special concern. Within the Silver Lead Creek riparian area there are several swampy areas with large pools of water, one of which contains the fir clubmoss, a Michigan species of special concern. Another sensitive habitat on K. I. Sawyer AFB includes three ponds, mapped as wetlands by the USFWS, which are located west of the runway. Water lilies were the only plant life associated with these ponds. Several man-made drainage ditches and other small wetlands within the airfield are regularly disturbed by ground maintenance activities (e.g., mowing) and are, therefore, considered to be of low quality.

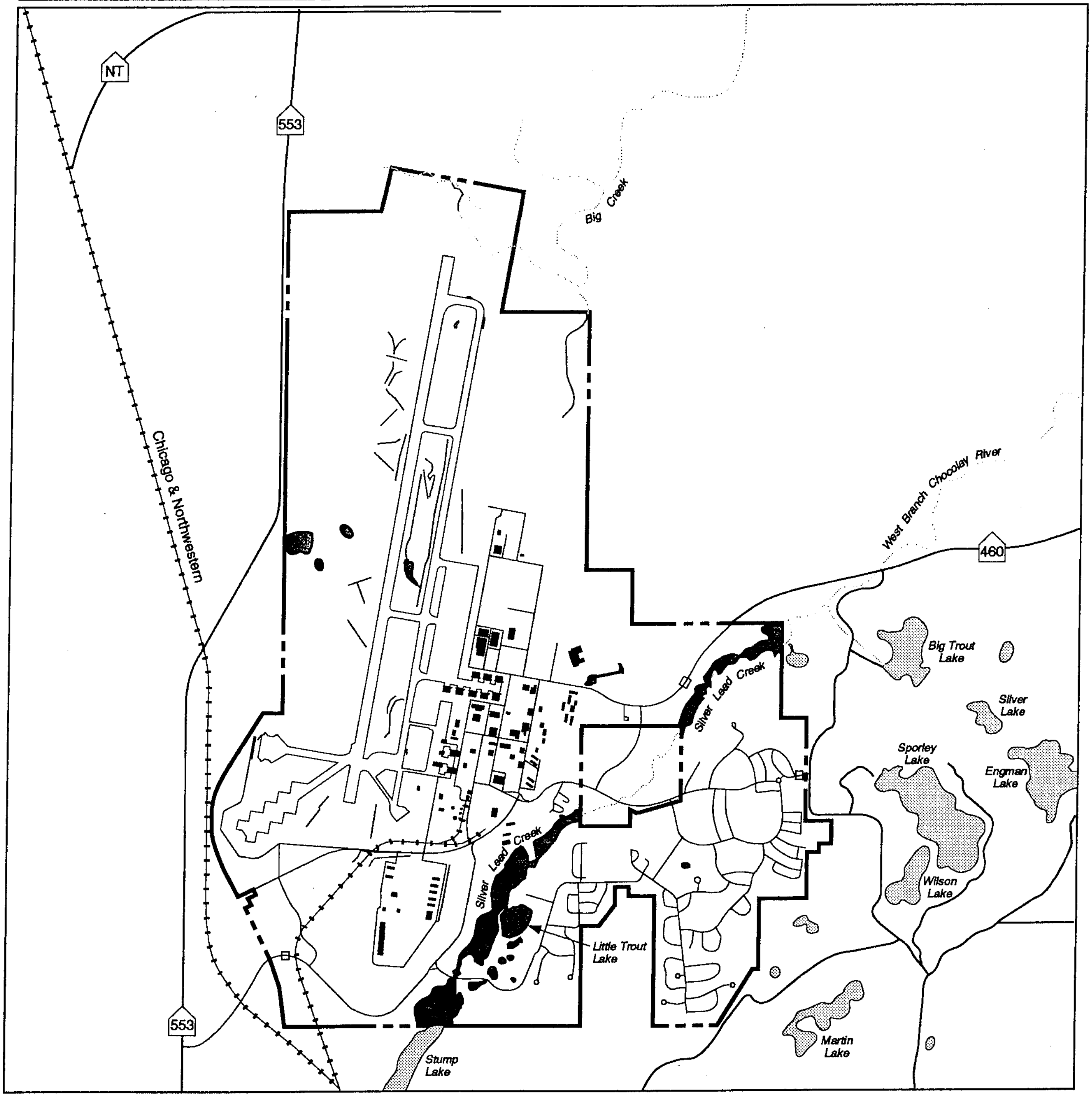
The MDNR assumed administration of the U.S. Army Corps of Engineers (COE) Clean Water Act, Section 404 wetlands program in August 1984, with the passage of Michigan's Goemaere-Anderson Wetland Protection Act (No. 203, Public Acts of 1979) and concurrence of the COE. Michigan's Goemaere-Anderson Wetland Protection Act defines wetlands as land characterized by the presence of water at a frequency and duration sufficient to support, and that, under normal circumstances, does support, wetland vegetation or aquatic life and is any of the following: (1) contiguous to the Great Lakes or Lake St. Clair, an inland lake or pond, or a river or stream; (2) not contiguous as above and is more than 5 acres in size (assuming the inventory in that county is complete); and (3) not contiguous as above and less than 5 acres in size if the MDNR determines that protection of the area is essential to the preservation of the natural resources of the state from pollution, impairment, or destruction and the MDNR has so notified the owner. The MDNR wetland definition follows USFWS criteria and is inclusive of wetlands defined by COE.

The USFWS mapped the wetlands on K. I. Sawyer AFB in fall 1993 (Figure 3.4-6). Of the 117 acres of wetlands mapped, most are swampy or boggy areas lining Silver Lead Creek. The slow-flowing stream is frequently dammed by beavers. The flooding of the land associated with the creek has resulted in substantial development of hydrophytic vegetation in shallow areas. Some smaller wetlands are associated with moist depressions near Silver Lead Creek. Thick mats of sphagnum moss support leatherleaf shrub. Cottonwood, red alder, black willow, American larch, and black spruce are common along the margins of swampy areas. In deeper areas, there are large pools of water. The margins of the pools are frequently lined with water lilies, cattails, rushes, and duck weed.

Habitat for threatened or endangered species is also considered sensitive. As discussed above, wetlands and open water habitats associated with Little Trout Lake and Silver Lead Creek provide the only known or probable habitats of threatened and endangered species on the base.

3.4.6 Cultural Resources

Cultural resources include prehistoric and historic sites, structures, districts, artifacts, or any other physical evidence of human activity considered important to a culture, subculture, or community for scientific, traditional, religious, or any other reason. Cultural resources have been divided for ease of discussion into three main categories: prehistoric resources, historic structures and resources, and traditional resources. Resources are defined in Appendix E, Methods of Analysis. For the purposes of this analysis, paleontological remains, the fossil evidence of past plant and animal life, have been included within the cultural resources category.



EXPLANATION

Wetlands

Base Boundary

0 950 1900 3800 Feet

Sensitive Habitat

Figure 3.4-6

The ROI for the analysis of cultural resources minimally includes all areas within the base boundaries, whether or not certain parcels would be subject to ground disturbance. For this analysis, the ROI is synonymous with the Area of Potential Effect (APE) as defined by the National Historic Preservation Act (NHPA). The potential conveyance of federal property to a private party or nonfederal agency constitutes an undertaking, or a project that falls under the requirements of cultural resource mandates, because any historic properties located on that property would cease to be protected by federal law.

Numerous laws and regulations require federal agencies to consider the effects of a proposed project on cultural resources. These laws and regulations stipulate a process for compliance, define the responsibilities of the federal agency proposing the action, and prescribe the relationship between other involved agencies (e.g., State Historic Preservation Office, the Advisory Council on Historic Preservation). Methods used to achieve compliance with these requirements are presented in Appendix E.

Only those potential historic properties determined to be significant under cultural resource legislation are subject to protection or consideration by a federal agency. The quality of significance in terms of applicability to National Register of Historic Places (NRHP) criteria and of integrity is discussed in Appendix E, Methods of Analysis. Significant cultural resources, either prehistoric or historic in age, are referred to as "historic properties."

In compliance with the NHPA, the Air Force has initiated the Section 106 review process with the Michigan State Historic Preservation Officer (SHPO). A record and literature search was conducted, which revealed that one archaeological survey had been conducted on K. I. Sawyer AFB (Kachel, 1990), which consisted of a pedestrian survey and shovel testing of 7 acres at the northwest corner of the base. No cultural resources were discovered. No other surveys were conducted on the base or within 2 miles of the base prior to 1994.

In May and June 1994, an archaeological Phase I survey incorporating shovel testing was conducted on K. I. Sawyer AFB (Commonwealth Cultural Resources Group, 1994b). Three prehistoric sites (20MQ89, 20MQ90, and 20MQ91) and four historic sites (20MQ88, 20MQ92, 20MQ93, and 20MQ94) were discovered. All three prehistoric and two of the historic sites were tested during a Phase II evaluation conducted in November 1994. These sites are described in Subsections 3.4.6.1 and 3.4.6.2, respectively.

3.4.6.1 Prehistoric Resources. The physiography and climate of Michigan have supported a cultural chronology dating to the post-glacial late Pleistocene. Three major divisions of prehistory are generally represented in the region and consist of the Paleo-Indian Period (10,000 B.C. to 8000

B.C.), the Archaic Period, contemporary with and following the Paleo-Indian Period (8000 B.C. to 1000 B.C.), and the Woodland Period (ca. A.D. 0 to A.D. 1600).

Paleo-Indian Period. Evidence of early Paleo-Indian (groups inhabiting the area between 10,000 and 8000 B.C.) is currently limited to the southern Lower Peninsula. The archaeological record for the Upper Peninsula begins with late Paleo-Indian groups. These people are thought to have been nomadic hunters who relied heavily upon large game, such as elk and caribou. These groups represent the Big-Game Hunting Tradition that can be traced throughout North America. They also practiced "opportunistic exploitation of a variety of other resources" (Commonwealth Cultural Resources Group, 1994b) in this newly created boreal lake shore environment resulting from post-glacial lake recession.

Archaic Periods. Subsistence technologies expanded during the Early (ca. 8000 B.C. to 3000 B.C.) and Middle (ca. 3000 B.C. to 1200 B.C.) Archaic Periods, with a shift to more gathering activities in the rich, deciduous, forest-riverine environments of the Lower Peninsula. Hunting emphasis shows a shift from primary big game hunting to fishing and other smaller game exploitation. Early Archaic sites are virtually absent in the Upper Peninsula, although Early Archaic-like material has been identified in Marquette County. The Old Copper culture, "which is primarily identified as a mortuary complex, flourished during the Middle Archaic Period" (Commonwealth Cultural Resources Group, 1994b), represented by extensive aboriginal mining pits found along the spine of the Copper Range (Commonwealth Associates, Inc., 1980). Material evidence for both periods is limited to scattered surface finds in the north. During the Late Archaic Period, the area began experiencing environmental conditions similar to the present; however, it is unlikely that large populations could have supported themselves year-round on the western Upper Peninsula due to the scarcity of resources in the winter.

Early and Middle Woodland Periods. During the Woodland Period (ca. A.D. 0 to A.D. 1600), technological innovations, such as ceramics and new fishing implements, contribute to a centralization and increase in size of sites. Early Woodland occupations are not well documented in the Upper Peninsula. Middle Woodland Period (A.D. 0 to A.D. 500) sites represent the first widespread introduction of ceramics in the archaeological record. "Settlement and subsistence patterns suggest seasonal fishing, collecting, and hunting with an increasing emphasis on aquatic resources" (Commonwealth Cultural Resources Group, 1994b).

Late Woodland Period. The Late Woodland Period lasted from ca. A.D. 500 until European contact. Beginning around A.D. 1000, the material culture reflects the influence of the Upper Mississippi River Basin and led to a mixed Late Woodland-Upper Mississippian assemblage (Franzen and Weston,

1973). The introduction of agriculture to the western Upper Peninsula and the large number of known Late Woodland and Upper Mississippian archaeological sites may indicate that the area supported a relatively large prehistoric population (Franzen and Weston, 1973).

Native American cultures were dramatically affected by European influences, land use, and political control. French explorers, traders, and Jesuit missionaries began making contact with Native Americans in the upper Great Lakes ca. 1650 (Cleland, 1972; Commonwealth Cultural Resources Group, 1994b). During this time, as political control of the area passed from French (pre-1760), to British (post-1760), and finally American (1769 to present) jurisdiction, the Native Americans changed in many respects as they became increasingly dependent upon European technologies (Commonwealth Cultural Resources Group, 1994b).

Three prehistoric sites (20MQ89, 20MQ90, and 20MQ91) were discovered during the 1994 Phase I survey. They included a small lithic scatter, a small domestic campsite containing ceramics (not a common occurrence for Upper Peninsula interior sites), and a relatively high-density lithic scatter, respectively. Sites 20MQ90 and 20MQ91 are on small, well-drained terraces adjacent to Little Trout Lake, while 20MQ89 is in the swamplands that parallel Silver Lead Creek.

Because all three sites exhibited little or no surface disturbance, there was an increased potential for intact subsurface features, such as hearths evidenced by the presence of fire affected rock. A Phase II evaluation was recommended and implemented to assess the significance and integrity, as well as define the vertical and horizontal boundaries of each site. Site 20MQ89, a low-density lithic scatter produced neither diagnostic artifacts nor subsurface features. Consequently, it is not recommended as eligible for listing in the NRHP. Sites 20MQ90 and 20MQ91 contained subsurface features (hearths/fire pits) and a substantial number of artifacts, subsistence remains, and datable organic remains. Both sites are located adjacent to wetland and/or swamp environments that are known to have prehistorically occurred within the headwaters of the region. The potential to address research questions important to understanding the prehistory of the interior regions of the Upper Peninsula is evident, and the sites have been determined eligible for listing in the NRHP. The Michigan SHPO has concurred with the above determination.

3.4.6.2 Historic Structures and Resources. By the nineteenth century, the fur trade had dwindled and was replaced by mining and lumbering industries, particularly after Michigan became a state in 1837. The discovery of copper and iron (shipped on the Great Lakes and by rail to the industrial cities of Chicago, Pittsburgh, Cleveland, and Detroit) drew commerce and European immigrants (e.g., Welsh, French Canadians, Swedes, Germans, Finns, Irish, Italians, and Slavs) to the Upper Peninsula. Major towns such as Marquette,

Negaunee, and Ishpeming developed around the mines. "Iron mining remains the county's largest private-sector employer" (Commonwealth Cultural Resources Group, 1994b).

Extensive stands of white pine and hardwoods provided lumber for the expanding railroads, as well as for housing and commercial structures. Sawmills and paper-making plants developed along the rivers. As a result of the excessive logging, most of the virgin pine forests had been removed by the 1900s. Jack pine was harvested for paper pulp and blueberry fields were abundant.

"A major factor in the economic development of the project area and its immediate environs was the founding of K. I. Sawyer AFB" (Commonwealth Cultural Resources Group, 1994b). The land currently occupied by K. I. Sawyer AFB was primarily farm and forest area. In 1955, the federal government signed a 99-year lease for use of the K. I. Sawyer County Airport. Under the control of the Air Force, an extensive expansion of the facilities was begun. The initial mission of the base, under the Air Defense Command, was defense of the Sault Ste. Marie sector from possible attack by the Soviet Union via the North Pole. The base was further expanded between 1958 to 1961 to accommodate SAC, whose mission was to maintain bombers and tankers on 24-hour alert.

Four historic sites (20MQ88, 20MQ92, 20MQ93, and 20MQ94) were identified during the archaeological Phase I survey in May and June 1994. Historic Sites 20MQ88 and 20MQ92 are late-nineteenth- and/or early-twentieth-century homesteads. Site 20MQ88 is comprised of a structural berm and root cellar depression and an associated trash dump, while Site 20MQ92 includes two trash scatters and a structural berm. Shovel testing at these two sites failed to reveal any undisturbed subsurface deposits or features that would provide stratified data to assess site usage through time. Further investigation at these sites "would not produce additional information pertaining to the age and function of these sites beyond that already established" (Commonwealth Cultural Resources Group, 1994b). The Michigan SHPO has concurred that these sites are not eligible for listing in the NRHP.

Sites 20MQ93 and 20MQ94 have been interpreted as a charcoal-producing "rural industrial complex" (Commonwealth Cultural Resources Group, 1994b). At Site 20MQ93, a beehive-shaped kiln, an excavated ridge prepared for the construction of a second kiln, and the structural remains of a large storage facility were identified. Shovel testing of the site resulted in the recovery of bottle glass that was deposited sometime during the first two decades of the twentieth century. Site 20MQ94, approximately 170 meters west of Site 20MQ93, consists of an excavated knoll similar to the one found at Site 20MQ93 and a clearing immediately south of the knoll. The excavated knoll had been faced with cut sandstone that was not

procured locally. Recovered artifacts consisted of a variety of ceramics, nails, and glass including solarized glass (clear glass altered by exposure to the sun over time), which indicate an occupation between approximately 1880 and 1915. Although there is some distance between the two sites, there is a dirt road leading from both to the Sands Railway Station. This suggests a functional link between the sites and transportation. Further archaeological investigation may establish the connection between the sites and contribute to our understanding of the methods of construction and unusual materials employed at these locations. Moreover, additional archival research has the potential to further develop the temporally and functionally historical context.

A Phase II evaluation revealed that sites 20MQ93 and 20MQ94 were, at one time, part of a farmstead originally owned by the Goodman family of Sands Township. Site 20MQ93 was confirmed as an abandoned charcoal kiln, which was operated until about 1915. The site also included the remnants of a large root cellar used to store potatoes after the farm shifted to potato production in the 1930s. Both of these structural features were found to lack integrity. Domestic artifacts recovered from site 20MQ94 occurred within plow zone sediments and appear to represent a disturbed trash deposit. As a result, neither site is recommended as eligible for listing in the NRHP. The Michigan SHPO has concurred with the above recommendations.

None of the extant buildings or structures at K. I. Sawyer AFB predate 1955; consequently, none of the facilities have attained the age of 50 years. However, the Air Force conducted an investigation of Cold War-era facilities at K. I. Sawyer AFB in order to evaluate whether they demonstrate exceptional significance, as recognized for properties less than 50 years old. The original inventory of 138 buildings was subject to review to ascertain the degree of integrity and presence of other evidence that would justify consideration for NRHP listing. Following this initial phase of the study, the inventory was narrowed; of the 138 buildings originally examined, 51 were selected for a formal evaluation because of their association with the alert missions conducted at the base. No further evaluation was deemed necessary for the 87 remaining facilities. Upon completion of the investigation, none of the buildings or structures formally evaluated were identified as eligible for inclusion in the NRHP. The Michigan SHPO has concurred with the above determinations.

3.4.6.3 Traditional Resources. Native American groups inhabiting the Upper Peninsula of Michigan at the time of European contact included Chippewas, Ottawas, and Menominee, all members of the Central Algonquian-language family.

In December 1993, consultation was initiated with the following Native American groups to ascertain if they had any concern with or could identify

sacred areas within the K. I. Sawyer AFB environs: Sault Ste. Marie Chippewa Tribal Council, Keweenaw Bay Tribal Council, Lac Vieux Desert Band of Lake Superior Chippewa Indians of Michigan, Hannahville Indian Community Council, and Bay Mills Executive Council. To date no groups or individuals have responded with any concerns.

3.4.6.4 Paleontological Resources. No fossil resources have been identified on or near the base. No listed or eligible National Natural Landmarks exist on K. I. Sawyer AFB.

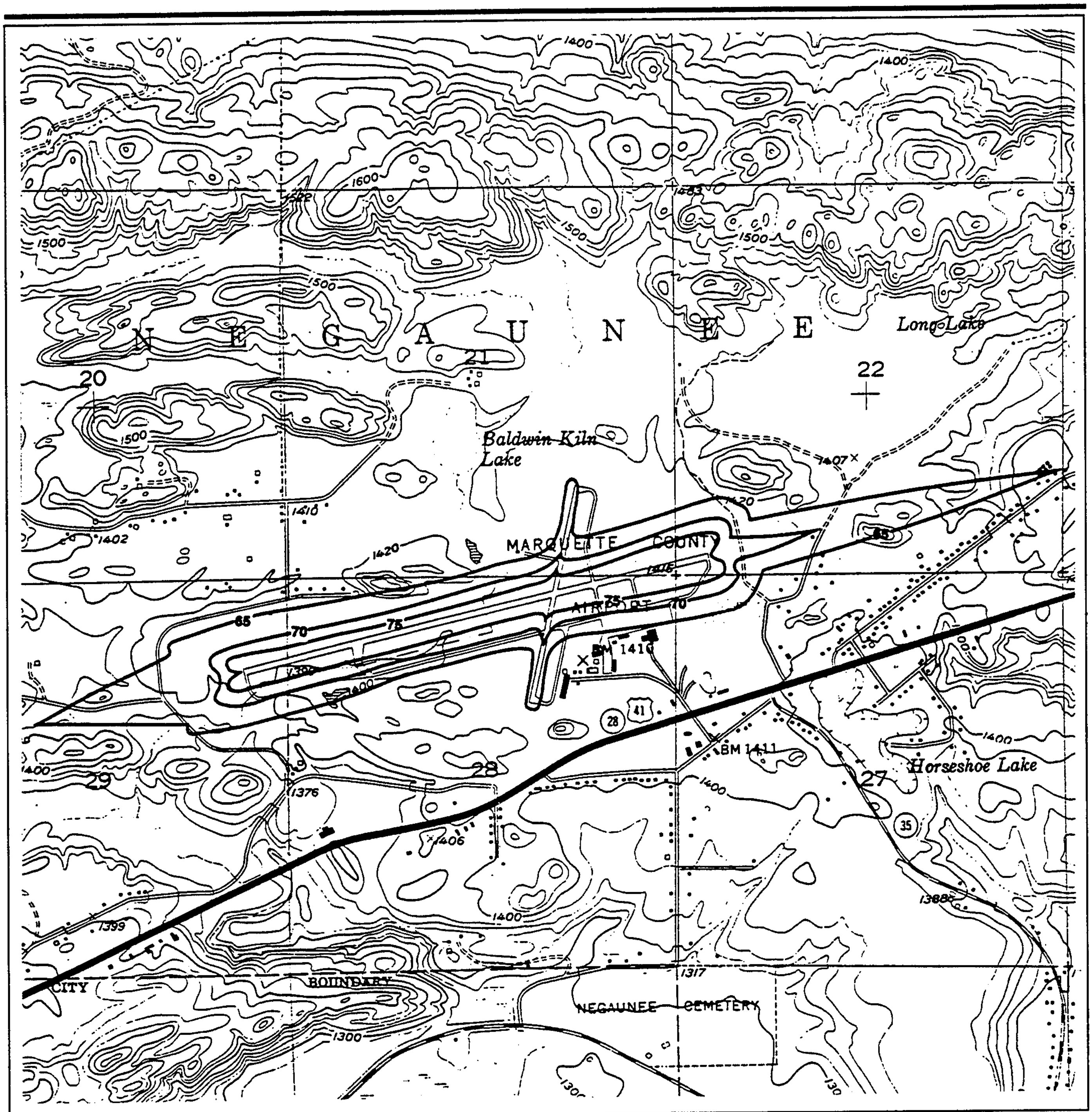
3.5 MARQUETTE COUNTY AIRPORT

This section summarizes the affected environment at Marquette County Airport in its current operational state. The environmental consequences of the potential closure and reuse of this site are summarized in Section 4.5. The description of the affected environment is provided below for each of the resource categories discussed in this chapter.

Community Setting. Marquette County Airport lies within Negaunee Township, approximately 7 miles west of the city of Marquette, and 4 miles east of the city of Negaunee along U.S. 41 (Figure 3.5-1). The airport consists of 670 acres of property with avigation easements on 90 acres and leases on 70 acres. The airport has one main terminal building and several maintenance hangars. The facilities at the airport were constructed between the late 1950s and 1989. At its peak in 1991, direct airport-related employment was estimated at 408, with a secondary employment of 386 (Greiner, Inc., 1990, 1991). However, employment at the airport has recently decreased to approximately 300, with the loss of administrative personnel from a regional airline operation.

Land Use and Aesthetics. The Negaunee Township Comprehensive Plan was prepared in 1966 (Negaunee Area Planning Commission). The areas west, north, and east of the airport were identified as farm, rural, and forested, while the area south of the airport was identified for commercial development, with residential uses along U.S. 41.

Negaunee Township is responsible for zoning around the airport, although Marquette County has adopted an airport zoning ordinance for the immediate vicinity (Greiner, Inc., 1990, 1991). Most of the areas surrounding the airport have been zoned One-Family Residential (RC-1) by Negaunee Township. This designation allows for businesses and mobile homes among single-family residences. The area along U.S. 41 has been zoned as General Business (B-2), which allows for any business activity (i.e., commercial, industrial, entertainment). The Marquette County Airport zoning ordinance regulates operations within the vicinity of the facility to maintain airport approaches and clearances (Greiner, Inc., 1990, 1991).



EXPLANATION

65 DNL Noise Contours (5 dB intervals)

Marquette County Airport

0 500 1,000 2,000 Feet

Map Source: U.S. Geological Survey, 1953

Figure 3.5-1

The land uses in the vicinity of the airport consist of single-family residences located along local roads, with scattered commercial and industrial development along U.S. 41 and in the vicinity of the airport entrance. North, east, and west of the airport, the majority of the land is undeveloped forest. The only other land use of any significance is single-family residences along the Township roads.

South of the airport, the majority of the land is undeveloped forest except along U.S. 41 near the entrance to the airport. This area consists of commercial land uses that include a television station, gasoline station, restaurant, and motel. South of U.S. 41, across from the airport entrance, are public facilities/recreation land uses that include the police and health department administrative facilities, and single-family residences.

The area surrounding the airport is characterized by forested, rolling hills and numerous streams, wetlands, lakes, and some dispersed residential development. Vegetation in the area is mainly mixed forest, which contributes to distinct areas of differing visual sensitivity. On the airport property, areas of visual sensitivity include the wetland areas on the east and west end of the property, and the forested area along the northern boundary. The remainder of the property has been developed for airport uses.

Transportation. Access to the airport is provided by U.S. 41, the main four-lane, east-west highway providing regional access between Marquette and Negaunee. SH 35, less than a mile east of the airport, is a two-lane highway providing access to Gwinn just south of the base and continuing southeast to Escanaba. In the vicinity of the airport, the AADT on U.S. 41 is 9,000 with an LOS of C. The LOS on U.S. 41 improves to B east and west of the airport. At the intersection with U.S. 41, the AADT on SH 35 is 3,900 with an LOS of D. South of U.S. 41, the AADT on SH 35 is 2,300 with an LOS of B (Michigan Department of Transportation, 1993).

The airport provides commercial passenger, aircraft maintenance, and general aviation services, and has approximately 76 based aircraft. The main airport runway is approximately 6,500 feet long and 150 feet wide. The airport also has a crosswind runway 3,000 feet long and 75 feet wide. In 1992, there were approximately 34,000 aircraft operations conducted at the airport with 40,000 passengers enplaned. No scheduled air cargo service is provided at the airport (Greiner, Inc., 1990, 1991). A description of the airspace surrounding the airport is provided in Section 3.2.3, Transportation. Airport radar service at Marquette County Airport is provided by equipment at K. I. Sawyer AFB through the Minneapolis ARTCC.

Utilities. The airport activity results in the consumption of water, electricity, and natural gas, and the generation of solid waste and wastewater. Water to the airport is provided by the Negaunee Township water system,

electricity by the Marquette Board of Light and Power, and natural gas by the Michigan Gas Company. The Negaunee WWTP receives domestic sanitary waste, and solid waste is taken to the Marquette County Landfill.

In 1994, the average daily water use at the airport was 0.0043 MGD, the average daily wastewater generated was 0.0045 MGD, and the annual electrical use was 2,604,918 kilowatts. No data were available on solid waste generation and natural gas consumption at the airport. The Negaunee Township water system has a design capacity of 0.8 MGD, with an average daily water consumption within the service area of 0.12 MGD. The capacity of the Negaunee WWTP is 2 MGD, with an average daily demand of 0.75 MGD. Descriptions of Marquette Board of Light and Power, Michigan Gas Company, and Marquette County Landfill are provided in Section 3.2.4, Utilities.

Hazardous Materials and Hazardous Waste Management. General aviation and aviation support activities require the use of a number of hazardous materials including aviation fuels, glycols, POL, solvents, paints, thinners, hydraulic fluids, degreasers, corrosives, heavy metals, and reactives. Hazardous wastes generated by the use of these materials include waste fuels, POL, solvents, thinners, and paints.

An environmental audit conducted in 1991 identified locations at Marquette County Airport where the release of aviation fuel or other hazardous substances may have resulted in the contamination of soils. The areas of potential contamination include the Simmons maintenance and ground support facilities, the bulk fuel storage area, airport septic tank system, the Capitol City Express facility, the U.S. Exec Air facility, the VORTAC, the MDNR hangar, the Marquette County Line Shack, an abandoned landfill northeast of the airport, and the fire training area. An investigation to determine the type and extent of contamination at these sites is ongoing (Sunberg, Carlson and Associates, Inc., 1991).

Aviation fuel for Marquette County Airport is stored in three 20,000-gallon fiberglass USTs that meet all regulatory requirements. In addition, there are other storage tanks on the airport property that are associated with some of the private operations. No surveys for radon, lead-based paint, or asbestos have taken place at the airport. No PCBs are on the airport property and pesticides are not used in grounds maintenance activities.

Natural Environment

Geology and Soils. The physiography of the area around Marquette County Airport is rolling plain dissected by stream and river channels, with an average elevation of 1,419 feet MSL. The geologic unit underlying the airport is surficial glacial deposits. Underlying the glacial deposits is metamorphosed Precambrian rock. The underlying bedrock has not been

tested for mineral resources; however, one of the most significant mining districts in the region is 4 miles to the east in Negaunee. No major earthquake faults or physical or geologic features are known to exist in the area, and the site is within a Seismic Hazard Zone 0. Based on the local geology, there is little potential for ground collapse from sinkhole, landslides, liquefaction, or related natural hazards.

Soils at Marquette County Airport include Michigamme, Au Gres sand, Evart/Winterfield, Carbondale/Tawas, Roscommon, Sayner-Rubicon, Histosols, Aquents, Croswell, Rubicon, and Greenwood/Dawson series. The airport property contains no prime or unique farmlands (Greiner, Inc., 1990, 1991).

Water Resources. Marquette County Airport is in the Superior Lake River Basin. The primary surface water features on the site are associated with a drainage along the western boundary of the airport that flows southwest into the Carp River. The airport has an NPDES permit for storm water runoff from the runways and apron areas. Samples collected at a potable water well at the airport showed no signs of groundwater contamination. The airport is not located within a 100-year floodplain (Sunberg, Carlson and Associates, Inc., 1991).

Regionally, there are several different geologic units that are suitable aquifers for the development of domestic water supplies, although their potential is limited. Well yields vary but generally range from 1 to 5 gallons per minute. The depth to groundwater at the site is approximately 20 feet below the ground surface. Water to the airport is supplied by the Negaunee Township water system. Twenty-four wells exist in the vicinity of the site; four of these are within the airport property (Sunberg, Carlson and Associates, Inc., 1991).

Air Quality. The area surrounding Marquette County Airport is in attainment for all criteria pollutants. For a description of the climate conditions and regional emission sources, see Section 3.4.3, Air Quality.

An emissions inventory (Table 3.5-1) was calculated for Marquette County Airport using 1989 aircraft activity levels and employment obtained from the Marquette County Airport Master Plan Study (Greiner, Inc., 1990). Emissions were calculated for three sources: aircraft flight operations, GSE, and commuting vehicles. Aircraft flight and GSE emission factors were obtained from the most recent version of EDMS, with appropriate engine substitutions made where necessary. Commuting vehicle emissions were calculated using emission factors from MOBILE5.0a. Criteria pollutant emissions are presented below.

Noise. A noise analysis for the Marquette County Airport was conducted as part of the Marquette County Airport Master Plan. Approximately 31,894

3.5-1. Emissions Inventory for Marquette County Airport, 1989

Source	Emissions, tons/day[a]				
	VOC	NO_x	CO	SO_x	PM_{10}
Aircraft Flight Operations	0.02	0.01	0.87	0.00	0.00
Ground Support Equipment	0.01	0.00	0.02	0.00	0.00
Commuting Vehicles	0.01	0.03	0.19	0.00	0.00
Total	0.04	0.04	1.08	0.00	0.00

Note: (a) Emissions less than 0.005 tons/day are rounded to 0.00 tons/day.
CO = carbon monoxide
NO_x = nitrogen oxide
PM_{10} = particulate matter equal to or less than 10 microns in diameter
SO_x = sulfur oxide
VOC = volatile organic compounds

aircraft operations for 1989 were modeled and consisted of single- and twin-engine propeller aircraft and general aviation jet. The analysis indicated that approximately 35 acres of the 307 total acres contained within the DNL 65 to 70 dB range are off airport property (Greiner, Inc., 1990). The 35 off-site acres are undeveloped and therefore the land use is compatible with the aircraft noise. The DNL 70 dB and greater noise contours were contained within the airport property.

Biological Resources. Most of the vegetation on Marquette County Airport property consists of landscaped areas with grasses, forbs, scattered shrubs, and small trees. Vegetation in areas adjacent to the airport includes flat, cleared areas with regrowth of native grasses, shrubs, and small second-growth trees; a wetland area; and wooded areas dominated by conifers, similar to those surrounding K. I. Sawyer AFB.

Development of airport facilities and disturbance of land at the end of the runways has degraded the quality of habitat. Small populations of a variety of common mammals, birds, amphibians, and reptiles have been identified and/or may be expected to occur in the vicinity of the airport. Mammals include coyote, cottontail rabbit, woodchuck, raccoon, striped skunk, chipmunk, and other small rodents. Whitetail deer are occasionally sighted in the area. Bird species include barred owl, pileated woodpecker, raven, crow, Cooper's hawk, woodcock, and a variety of songbirds, including yellow-rumped warbler and song sparrow. Waterfowl, including mallards and Canada goose, may be seasonal visitors to wetland areas on the property. Amphibians and reptiles may include painted turtle, wood turtle, wood frog, spring peepers, five-lined skink, red-bellied snake, and common garter snake.

Based on recent consultation with MDNR, Marquette Regional Office, there are no federally or state-listed threatened or endangered species known to be present on the airport property (Hendrickson, 1995).

Protection Act. There are several areas of shrub and/or emergent vegetation as well as three areas of open water as described by the USFWS. These three areas are at the west end of the main runway in the Clear Zone; south of the main runway; and south of Baldwin Kiln Lake, about halfway between the lake and the main runway. Water from this third location flows south, then southwest, along an intermittent drainage toward the west end of the main runway. From there, it flows through a wetland area of scrub shrub and emergent vegetation, then off the airport property, and eventually into the Carp River (see Figure 2.3-7).

There is also a wetland area (described as a bog) north of the north end of the crosswind runway. This area is not a contiguous wetland (i.e., it is not adjacent and contiguous to a body of water and is located more than 500 feet from an inland lake or stream); therefore it is not subject to the Goemare-Anderson Wetland Protection Act (Greiner, Inc., 1991). However, it is protected by Section 404 of the Clean Water Act.

Cultural Resources. No cultural resources surveys have been conducted in support of Marquette County Airport activities (Greiner, Inc., 1990, 1991). During preparation of environmental documents for a proposed runway expansion project, the SHPO was contacted in accordance with the NHPA. At that time, the airport received a determination of "no historic properties found" from the SHPO (Greiner, Inc., 1991).

3.6 SAWMILL TIMBER PROCUREMENT AREA

One of the proposed reuses at K. I. Sawyer AFB is the establishment and operation of a softwood sawmill capable of producing 75 million board feet of lumber per year. This land use concept is briefly described in Section 2.3.5, Other Land Use Concepts. The timber processed in the sawmill is expected to be obtained from the northern Lower Peninsula of Michigan, the Upper Peninsula of Michigan, and northeast Wisconsin (Figure 3.6-1), with most of the harvest anticipated to occur in Michigan. This section summarizes the affected environment for the timber procurement area and includes a description of those resources likely to be affected. Because utility use for timber harvesting activities is expected to be minimal, no impacts are anticipated, and therefore, this resource in not analyzed further. The programmatic environmental consequences of the timber harvesting activities within this area are summarized in Section 4.6. The direct environmental consequences of sawmill operations at K. I. Sawyer AFB are addressed under each resource in Sections 4.2 through 4.4 as an other land use concept.

EXPLANATION

Timber Procurement Area

Michigan/Wisconsin State Boundary

0 15 30 60 Miles

Sawmill Timber Procurement Area

Figure 3.6-1

3.6.1 Timber Resources

The characteristics of the timber inventory, the factors affecting management of the individual softwood species, and the ownership of the timbered lands in the procurement area are discussed in this section.

3.6.1.1 Timber Inventory. In order to evaluate the timber availability within the procurement area, a timber supply analysis for a sawmill at K. I. Sawyer AFB was prepared (George Banzhaf & Company, 1995b) and is summarized below.

The region from which timber would be procured for the proposed sawmill extends from Marquette County for a distance of approximately 150 miles (air radius), throughout Michigan's Upper Peninsula, into the northern Lower Peninsula to the southeast, and northern Wisconsin to the southwest. The timber procurement area is heavily forested, with timberland comprising about 80 percent of the total land base in the Upper Peninsula and about 70 percent in the other two areas. Analysis of the timber resources in the proposed procurement area is summarized below.

- The gross inventory of the required softwood species in the procurement area is 5.1 billion cubic feet, and net annual available growth is 97 million cubic feet.

- Much of the resource is in the 10-inch and larger diameter classes, indicating that a high proportion of the total inventory will be suitable for harvest over the next 20 to 30 years.

- Overall, the forest is growing at an average annual rate of 2.5 percent, although this varies according to species. Of the major species groups, the fastest growing type is the red/white pine, at 3.7 percent per year.

- "Availability factors" for the timbershed were developed to estimate the net resource available for industrial use. Based on the distribution of species among ownership groups (e.g., private, state, federal), the average availability is about 75 percent, and ranges from about 66 to 77 percent by species.

- There are a variety of wood-using industries in the timbershed, which together create an annual demand for industrial roundwood of about 4.5 million cords, or 354 million cubic feet. Approximately half of the total harvest is within 80 miles of Marquette, and about 75 percent is within 120 miles. Estimated harvest of the required softwood species is 78.8 million cubic feet, or 12 times the requirements of the proposed sawmill.

- Pulpwood production increased significantly in the timbershed during the 1978-1993 period, due to incremental increases in demand caused by increased pulp production capacity in the region and due to the start-up of new composite board plants of various types.

3.6.1.2 Softwood Characteristics. In order to understand why certain silvicultural systems are used in forest management, it is necessary to understand how individual tree species respond, in terms of growth and vigor, to their surrounding environment. This relationship is known as silvics. The primary factors to consider for successful timber management include range of temperature, light, moisture, topography, soil condition, and, under extreme conditions, air movement. The silvics of the timber resources within the proposed procurement area are discussed in this section. Because the proposed sawmill would utilize softwoods (i.e., conifers), a brief description of the silvics of each major conifer type expected to be harvested in the timber procurement area is provided below.

Black spruce (*Picea mariana*), also known as bog spruce and swamp spruce, is very tolerant of shade (i.e, it can grow well without direct sunlight). Black spruce is found in wet organic soils, but can grow in coarse till and shallow soils over bedrock. The species produces good seed crops at intervals of 2 to 6 years, and seed dissemination is effective up to about 260 feet. Black spruce responds very well to release from competition (U.S. Department of Agriculture, Forest Service, 1990). Black spruce can be clearfelled using strip cuts, patch cuts (if natural regeneration is desired), or clearcuts. Clearcut sites are generally regenerated with artificial seeding where an adequate seedbed exists; planting can be used when the seedbed is not adequate. Because of its susceptibility to dwarf mistletoe (a parasitic pathogen) and its general lack of wind firmness, shelterwood and seed tree systems are not employed on a large scale (Jaakko Poyry Consultants, Inc., 1992b).

Balsam fir (*Abies balsamea*), also known as balsam, Canadian balsam, and eastern fir, is very tolerant of shade. The species occurs on a wide range of organic and inorganic glacial soils. The balsam fir produces good cone crops every 2 to 4 years, and is capable of effectively disseminating seed to distances of 80 to 200 feet. Balsam fir's response to release from competition is considered good (U.S. Department of Agriculture, Forest Service, 1990). It has been recommended that harvesting should be conducted using strip cuts or patch cuts. Because balsam fir is managed primarily for pulpwood, and because of its susceptibility to spruce budworm infestation, conversion to other species to break up pure stands of balsam fir is practiced (Jaakko Poyry Consultants, Inc., 1992b).

Red pine (*Pinus resinosa*), also known as Norway pine, is a shade intolerant species (i.e., it requires almost full sunlight for its growth and development).

Natural stands are largely confined to sandy soils, generally formed from glacial or wind-borne deposits. The species can grow on dry, low fertility soils, but can also be found in other soils, such as along swamp borders. Red pine produces good seed crops at intervals of 3 to 7 years, and thinning has been shown to assist seed and cone production. Effective dissemination of seeds from the tree is about 40 feet. Red pine exhibits its best growth in even-aged groups or stands, and is well adapted to even-aged management (U.S. Department of Agriculture, Forest Service, 1990). Even-aged management, using multiple commercial thinnings to obtain forest products, such as pulpwood, posts, poles, cabin logs, pilings, and small sawtimbers, has been recommended. Because seed tree methods have been shown to be ineffective, clearfelling and replanting with bare-root or containerized seedlings or, where other multiple-use objectives are a high priority, shelterwood silvicultural systems are recommended (Jaakko Poyry Consultants, Inc., 1992b).

Jack pine (*Pinus banksiana*), also known as scrub pine, Hudson Bay pine, and Banksian pine is a shade intolerant species and is found on sandy and loamy soils. Jack pine can grow on very dry, sandy or gravelly soils where other species cannot survive. Jack pine cones usually produce seed every year. Seed dissemination from the tree is generally limited to the tree height distance (about 40 feet). Jack pine cones may open during hot weather, however; in many areas of its range, cones are dependent on fire before seeds are released. Jack pine is a pioneer species, taking advantage of burns or other exposed sites. It will be succeeded by red pine fairly rapidly on all but the poorest, driest sites (U.S. Department of Agriculture, Forest Service, 1990). Even-aged management, using clearfelling (and replanting with bare-root or containerized seedlings) or seed tree silvicultural systems has been recommended for jack pine (Jaakko Poyry Consultants, Inc., 1992b).

Eastern white pine (*Pinus strobus*), also called white pine and northern white pine, is moderately tolerant to shade. White pine grows on nearly all the soils within its range, but generally competes best on well drained sandy soils. On these soils, white pine regenerates naturally and competes easily. The species produces good seed crops every 3 to 5 years; seeds are wind disseminated at distances from 200 feet to more than 700 feet in the open. The response to release from competition is variable, depending on species age and size, and other site conditions. In general the reaction to competition decreases with age and suppressed crown form (U.S. Department of Agriculture, Forest Service, 1990). White pine can be regenerated through several silvicultural methods including clearcutting, patch cutting, shelterwood, and group selection. Natural seeding can be used if harvests are timed to coincide with good cone production years and if an adequate (mineral soil) site bed is prepared. Artificial planting can also be used on certain sites (Jaakko Poyry Consultants, Inc., 1992b).

Eastern hemlock (*Tsuga canadensis*), also known as Canada hemlock and hemlock-spruce, is very tolerant to shade. The species can be found on soils that are moist to very moist with good drainage. Eastern hemlock exhibits good cone production for 2 of every 3 years, and the seeds generally fall within the tree height. When thinned, the response to release from competition is extremely good. In the Great Lake States, uneven-aged management of eastern hemlock has not been successful (U.S. Department of Agriculture, Forest Service, 1990). A two- or three-cut shelterwood system has been identified as the best even-aged management system for regenerating eastern hemlock because it promotes seed germination and early seedling development by reducing moisture stress.

Tamarack (*Larix laricina*), also known as American larch, Alaska larch, and eastern larch, is very intolerant to shade. Tamarack is found on wet to moist organic soils, such as sphagnum peat or woody peat. The species produces good seed crops at intervals of 3 to 6 years, and seed dissemination is effective to about two tree heights. The response to release from competition of tamarack is considered poor. Because of its intolerance to shade, its wind firmness, and because its seeds germinate better in the open, tamarack is best regenerated through clearcut or seed tree methods (U.S. Department of Agriculture, Forest Service, 1990). Artificial regeneration using tamarack is in the experimental stage due to the cost and difficulty of obtaining seed (Jaakko Poyry Consultants, Inc., 1992b).

Northern white-cedar (*Thuja occidentalis*), also known as arborvitae and eastern white-cedar, is a shade tolerant species. Northern white-cedar prefers cool, moist nutrient-rich sites, and is particularly well adapted to organic soils along drainages. The species produces good seed crops every 2 to 5 years; seeds are wind disseminated usually from 150 to 200 feet. As seeds are not viable in nature after 1 year, they should not be considered a reliable reforestation source after fire or clearcutting. Northern white-cedar responds well to release from competition at all ages (U.S. Department of Agriculture, Forest Service, 1990). White cedar is managed for wildlife value and wood products, such as posts, poles, and logs. In planning mixed conifer stands, northern white cedar can be naturally regenerated from adjacent seed sources using strip or patch cuts, if the seedbed is prepared by burning (Jaakko Poyry Consultants, Inc., 1992b).

3.6.1.3 Timber Ownership in the Procurement Area. Four major classifications of land ownership have been identified within the proposed timber procurement area (George Banzhaf and Company, 1995b). These include federal lands (i.e., National Forests), state and county-owned lands, private industrial forest lands, and private nonindustrial forest lands. Minor land ownership classifications include those held by Native American groups and farming interests, and these are not discussed below. Each land ownership type exhibits different management approaches, as defined by

regulations or management practices. Implementation of best management practices (BMPs) is integral to the planning associated with timber management activities on public lands and private industrial forest lands, and is largely incorporated into management of nonindustrial private forest lands.

BMPs are the methods employed to prevent or reduce the environmental effects of timber management activities, and to increase the long-term health and vigor of the timber resource. Specific BMPs may vary somewhat between ownership types and objectives, and site conditions. A brief summary of ownerships and management practices including implementation of BMPs is discussed below. BMPs provide many specific recommendations on how to avoid polluting the environment associated with forest lands from harvesting activities. Some general BMPs include: using biodegradable lubricants whenever practical; using buffer strips around water bodies to trap and filter out suspended sediments before they enter the water; planning road systems that minimize the number, width, and length of roads to limit the area of disturbance; minimizing the number of stream crossings; installing stream crossings using materials that are clean, nonerodible and nontoxic to aquatic life; locating timber collection areas outside of riparian management zones; avoiding operating equipment on slopes greater than 30 percent that drain into water bodies; and applying chemicals only under favorable weather conditions. Both the state of Michigan and Wisconsin have BMP manuals that go into detail on all of the applicable BMPs that could be used for timber harvesting activities (Michigan Department of Natural Resources, 1994; Wisconsin Department of Natural Resources, 1995).

National Forest System Lands. Timber production on National Forest system lands is largely managed in accordance with the National Forest Management Act (NFMA) (16 U.S.C. 1600 et seq.), among other applicable laws and regulations. The NFMA stipulates the practices under which National Forest timber can be harvested or otherwise disposed of.

The U.S. Forest Service generally employs commercial timber sales for timber harvest activities. Other methods include administrative use, free use, and disposal of miscellaneous forest products; however, these other methods have only a minor effect on sawlog supplies. Larger commercial timber sales generally are bid competitively through a sealed bid process. Sales are made on appraised volume, and once purchased, the buyer of a commercial sale has an obligation to cut and remove all designated trees within the contract area, unless the trees have been specified to be left standing.

Timber sales on National Forest lands are generally subject to review under NEPA. Environmental analysis occurs on a programmatic basis (i.e., through a National Forest Plan EIS) and through site-specific environmental assessments. Sale areas are laid out in accordance with National Forest

guidelines, including those found in the Forest Service Directives and implemented within individual Forest Plans. Timber sale areas are determined by Forest Service resource personnel, who will set boundaries, identify skidding roads and trails, and mark individual trees or identify forest areas for harvest. In addition to identifying the trees or areas, Forest Service personnel will determine the volume of timber designated for harvest.

Timber sale contracts set the standards by which the performance of logging contractors is measured (Jaakko Poyry Consultants, Inc., 1992d). Contractual provisions will generally include the application of BMPs regarding method of cutting, disposal of slash, environmental protection, and other practices. The buyer must generally procure and deliver a performance bond for a specified dollar amount prior to the onset of harvest operations. Damage caused to forest resources or other contract violations by the buyer can be debited from that bond or corrections can be sought through other contractual means. Forest Service timber sale administrators are responsible for inspecting harvested areas to ensure that contract specifications, including those preventing residual stand and environmental degradation, have been met.

The National Forest system lands in Michigan and Wisconsin are all managed within the North Central Region (Region 6) of the Forest Service. All or portions of the Hiawatha, Ottawa, Huron, and Manistee National Forest in Michigan, and the Nicolet and Chequamegon National Forests in Wisconsin are located within the proposed timber procurement area. National Forest lands comprise 2.2 million acres, or about 16 percent of the total timber procurement area (George Banzhaf and Company, 1995b).

Michigan State and Local Government-Held Lands. State and local government controlled timber lands in Michigan and Wisconsin comprise over 2.1 million acres or about 16 percent of the procurement area. State forests in Michigan include Copper Country, Escanaba River, Lake Superior, Mackinaw, Pere Marquette River, and Au Sable River. The state of Michigan has developed a Statewide Forest Resources Plan which requires the development of regional forest plans throughout forested areas of the state. State forests in Michigan are managed by MDNR, which applies a multiple use approach to their administration. The policy of the MDNR is to manage the state forests to yield a combination of products and services which best meets the physical, psychological, and spiritual needs of all the people now and in the future. MDNR's objective is to identify management opportunities and provide for the combination of products, services, and amenities that will be of greatest public benefit (Michigan Department of Natural Resources, 1991).

Michigan's State Forests are generally harvested through timber sale contracts, in a manner similar to that described for National Forest system

lands. BMPs are incorporated into contract provisions, with a performance bond enforcement mechanism.

The Michigan Sand Dune Protection and Management Act (Public Act 222) protects certain critical dune areas from damage and destruction resulting from activities associated with construction, recreation, and timber management. All such uses are controlled and regulated by a permit process (Michigan Department of Natural Resources, 1994).

The Michigan Natural Rivers Act (Public Act 231, 1970) requires MDNR approval of plans for the location and construction of any utility or publicly provided facility, including roads, bridges, and culverts within a designated Natural River area. Tributaries to these waterways are also controlled. All development and land uses occurring within 400 feet of designated streams are regulated by a combination of prohibitions including state and local zoning ordinances (Michigan Department of Natural Resources, 1994).

The Michigan Floodplain Regulatory Authority (Public Act 245) provides for a hydraulic review of stream crossing structures (i.e., bridges and culverts) to ensure that they have the capacity to withstand a 100-year flood event. This review occurs during the Act 346 review process. Public Act 346 establishes wetland water quality standards, and implementation procedures for the application of standards. Under Section 7 of Public Act 346, a permit must be obtained prior to dredging, filling, or construction below the ordinary high water mark, which would interfere with natural flows. Permanent and temporary stream crossing construction is generally regulated under this Act. The Act is essentially a duplicate of Section 404 of the federal Clean Water Act (Michigan Department of Natural Resources, 1994).

Wisconsin State and Local Government-Held Lands. In Wisconsin, state forests make up 4 percent of all commercial forest land and in the procurement area these include the Northern Highland and American Legion. The state of Wisconsin uses a State Forest Resources Assessment to assist in planning forest management activities. The state has also developed a forest management plan that is used as a model by the counties in developing their 10-year management plans (S.28.11, Wisconsin Statutes [WS]) (Mays, 1995). Wisconsin's county and municipal owned timber land is more extensive, occupying about 17 percent of commercial forest lands in the state. Each county is responsible for development of a 10-year plan to guide forest management activities on those lands. Currently, the counties are in the process of developing those plans for activities through the year 2005. County lands in Wisconsin are generally more intensively managed (i.e., oriented towards forest production) than other public lands in the state. Each of the counties having county-owned commercial forests has its own forester. In addition, counties and municipalities receive technical assistance from the Wisconsin Department of Natural Resources (WDNR). Municipal

lands in Wisconsin are managed for timber production, for educational purposes (i.e., school forest), and parkland (Mather, 1995).

In Wisconsin, timber is disposed on state, county, and municipal lands through timber sale contracts. In a manner similar to that described for National Forest system lands, a performance bond is collected and held until work is completed. Any environmental or residual stand degradation would be repaired using performance bond funding. Prior to harvesting timber in the state, approval must be obtained from the WDNR and designated by a forester (S.28.05(1), WS). On county forests, timber sale appraisal methods must be approved by the WDNR (S.28.11(6)(b)2, WS). On municipal forests that are registered with the WDNR, no trees may be cut except those marked or designated for cutting by a WDNR forester.

Pesticide sale, handling, and use are regulated under ATCP 29 (Wisconsin Administrative Code [WAC]). The code regulates the registration, licensing, certification, storage, and manufacturing of pesticides. Contingency plans for emergency response to hazardous substance spills, including those of pesticides, are regulated under S.144.76(2), WS. Dumping of waste oil is prohibited in Wisconsin (S.159.07[1m][b], WS).

State law prohibits the depositing of logging slash into lakes or streams (S.26.12[6], WS). Separate legislation regulates the depositing of deleterious substances (i.e., sand, stone, garbage, and sawdust) into navigable waters (S.29.29[3], WS). Permits must be obtained to place structures into waterways, divert surface water, alter stream courses, grade topsoil from the banks of streams or lakes, remove material from streambeds, or construct or maintain bridges or culverts for crossings of navigable waters.

Non-point-source water pollution regulations allow the WDNR to order the abatement of pollution which WDNR determines to be significant (S.144.025[2][u], WS). Financial assistance is also available to implement BMPs on those sites determined to be critical sources of non-point pollution.

Chapter NR 103 of the WAC, establishes wetland water quality standards and implementation procedures for the application of standards. Under Wisconsin law, a Chapter 30 permit or a federal Section 404 permit must be obtained for forestry activities that could affect wetlands. Forest management activities on state lands must include consideration of the NR 103 standards.

Wisconsin exempts most forestry practices from state laws regarding state listed endangered and threatened plants (S.29.415[4][c], WS). However, take of threatened or endangered animal species is prohibited (NR 27, WAC) (Wisconsin Department of Natural Resources, 1995).

Private Nonindustrial Forest Lands. Private nonindustrial forest lands in Michigan and Wisconsin comprise about 5.5 million acres, or over 40 percent of the proposed timber procurement area. Private nonindustrial forest lands include those non-public areas not owned by major commercial timber interests.

By their nature, private nonindustrial lands are managed depending on the objectives of the individual landowner. Private nonindustrial land management objectives in Michigan and Wisconsin are anticipated to be similar to those in Minnesota, where it was determined that smaller landowners (i.e., those holding less than 5,000 acres) that harvest timber were more likely to focus on the short-term economics associated with harvest alone, rather than the long-term goal of overall forest health (Jaakko Poyry Consultants, Inc., 1992c). Nonindustrial private land owners in Minnesota were less likely to employ BMPs than any other major forest owning group. On these lands, BMPs were adhered to about 92 percent of the time (George Banzhaf and Company, 1995b).

Michigan has developed educational programs and a tax incentive system for private landowners to assist their timber management efforts. There is no definitive policy surrounding private industrial and nonindustrial forest land management (Michigan Department of Natural Resources, 1991). The Commercial Forest Act (CFA) (94, Public Act 1925) authorizes the MDNR to establish and maintain commercial forests and promulgate and enforce appropriate rules. Under the CFA, private landowners can voluntarily enter their lands into a statewide commercial forest program that offers property tax incentives in exchange for participation. Once in the program, holders of commercial forest land are required to develop a forest management plan. Included within the plan are a list of BMPs that can, but are not required to, be implemented. Withdrawal from the plan can result in the application of penalties and increased property taxes levied by state and local government. However, reauthorization of the CFA included a grace period when owners could withdraw without these penalties. Changes in Michigan tax structure resulted in a reduction of lands included in the CFA program from 2.3 to 2.1 million acres. Regulations associated with protection of sand dunes, Natural Rivers, floodplains, and wetlands are described under Michigan State and Local Government-Held Lands. Cultural resources on private lands are not generally afforded protection in Michigan.

Wisconsin also provides tax incentives and educational assistance to private landowners to manage commercial forest lands. To be included in the tax incentive program, landowners must provide a forest management plan developed by a forester. BMPs are included in the plan, but their implementation is voluntary. In Wisconsin, a cutting notice must be filed with the applicable county clerk prior to harvesting operations on private timber lands (Wisconsin Statutes, S.26.03, WS). Other state laws preventing degradation of surface waters, or fish and game; and those

associated with pesticides, sewage, refuse, mining, air, solid waste, and vehicles are described under Wisconsin State and Local Government Controlled lands. For private lands in Wisconsin, those forestry activities requiring a Chapter 30 or Section 404 permit must comply with NR 103. For activities on private lands not requiring a Chapter 30 or Section 404 permit, compliance with NR 103 standards is not required. In addition to state regulations, local zoning ordinances can govern private forest management practices in Wisconsin. Cultural resources (with the exception of graves) on private lands in Wisconsin are not provided specific protection (Wisconsin Department of Natural Resources, 1995).

Private Industrial Forest Lands. Private industrial forest lands in Michigan and Wisconsin comprise approximately 2.1 million acres, or over 15 percent of the timber procurement area. Generally, the industrial forest lands are owned by timber product companies and are intensively managed for development of forest products. Silvicultural practices are applied for direct sustained economic benefit, and multiple use factors are considered secondary (Michigan Department of Natural Resources, 1991). In order to provide for sustained yield, those silvicultural practices associated with protection and maintenance of sustainable timber resources are employed, and therefore BMPs are generally applied. Implementation of these BMPs results in the protection of those resources in the forest environment especially those associated with protection of soils and water resources. In Minnesota, industrial forest land managers employ forest management BMPs on virtually all of their lands (Jaakko Poyry Consultants, Inc., 1994), and the same level of adherence is anticipated in Michigan and Wisconsin. Owners of industrial private forest lands are subject to the same regulatory controls as nonindustrial private landowners.

3.6.2 Land Use and Aesthetics

Most of the acreage in the timber procurement area is forest land and is managed for timber harvesting; therefore, the land use associated with this area is considered agricultural. This area also provides for protection of natural resources and outdoor recreational activities. BMPs on federal and state lands are implemented during timber harvesting activities so the visual, recreational, natural resource, and timber uses can be maintained. On private lands, which are maintained for recreational use, BMPs are implemented to protect this resource.

The timber procurement area is endowed with an abundance of natural resources and a wealth of outdoor recreational opportunities: hiking, viewing scenery and wildlife, horseback riding, camping, boating, swimming, fishing, cross-country skiing, snowshoeing, snowmobiling, and hunting. A study conducted in Minnesota for a similar area found that walking and hiking, bicycling, fishing, and driving for pleasure account for half of the annual outdoor recreation activities. Although summer is short, that is when

over half of all outdoor activities take place. Conversely, winter recreational activities account for only about 19 percent of the recreation activity hours (Jaakko Poyry Consulting, Inc., 1993).

Agencies at all levels of government and the private sector form a partnership in providing recreation opportunities. Each partner has its own goals and policies; some manage or provide recreation opportunities more intensively than others. The recreational opportunities occur within national and state forests and parks, county and regional parks, USFWS wildlife areas, and on recreation trails (e.g., snowmobile trails) on both private and public lands. Some recreational activities are regulated on a state level and require permits and/or instruction (i.e., hunting and fishing).

The timber procurement area consists of forested and somewhat level to rolling terrain interspersed with numerous streams and lakes. In the glacial lake plains region, the large stand size and relatively flat terrain do not typically allow for distance vistas. Areas considered more visually sensitive are found along water bodies near roads, trails, and campsites that are accessible to the public. Activities such as road and campground construction, timber harvest practices, and wildlife habitat improvements currently affect visual quality within the timber procurement area. Because of the varied ownership patterns in the region, activities on adjacent private lands can have the same effect on the visual resource as those on federal and state lands. Visual management guidelines are used in both federal and state forests to conserve aesthetic values (Michigan Department of Natural Resources, 1991). These guidelines assess the attractiveness and the sensitivity of a forest tract, and they assign a management objective to each tract based on its combined rating for attractiveness and sensitivity. BMPs in visually sensitive areas may include the use of patch cuts and shelterwood regeneration systems and buffer areas around receptor sites (i.e., roadways).

3.6.3 Transportation

Principal access routes through the timber procurement area include federal, state, and county highways and roads, and maintained and unmaintained dirt/gravel roads. Within the procurement area, the roads most affected would be the maintained and unmaintained dirt/gravel roads. These roads provide access for emergencies, timber management, and pleasure, including hunting, fishing, camping, and snowmobiling activities. Most of these roads were originally constructed as part of timber harvesting activities and may be maintained by federal and state landowners. Many of these roads are not maintained because of lack of use or funding. Because of the lack of funds, roads on private land are not typically maintained.

Roads within the forest on public land are planned and developed to minimize the number, width, and length of the roads in order to limit

disturbance. These consist of temporary roads, permanent seasonal roads, and permanent all-season roads. Temporary roads are the most common forest road and are designed and constructed for short-term use during specific projects such as timber harvesting. Permanent seasonal roads are maintained as part of the permanent road system but are designed for use only when the ground is frozen or firm. Permanent all-season roads are usually gravel surfaces and are designed for year-round use. For roads constructed on public lands, BMPs are used in the design to reduce potential impacts on the quality of water in nearby rivers and streams (Michigan Department of Natural Resources, 1994; Wisconsin Department of Natural Resources, 1995). These BMPs include avoiding water resources where possible, designing appropriate stream crossings where needed, and designing, constructing, and maintaining roads to ensure stable surfaces and restrict erosion. The use of BMPs for the construction of roads on private lands is voluntary. However, state permits are required for construction across water bodies.

Major transportation routes that could be used for hauling timber include U.S. 71 and 131 in the Lower Peninsula of Michigan; U.S. 2 and 41 and SH 2, 28, and 35 in the Upper Peninsula; and U.S. 8, 41, 51, and 141, and SH 17 and 64 in Wisconsin. Because of the rural nature of the timber procurement area, most of the roads provide an adequate LOS except in or near towns and cities where the road conditions drop to LOS D or F.

3.6.4 Hazardous Materials and Hazardous Waste Management

Hazardous materials and hazardous waste management activities associated within the timber procurement area include chemical management and spill management from timber harvesting activities.

Common chemicals used in forest management within the timber procurement area include pesticides (insecticides, herbicides, and fungicides) and fertilizers. These chemicals are used to control insects, unwanted vegetation and diseases, and to enhance tree growth (Michigan Department of Natural Resources, 1994). Herbicides constitute the primary pesticide usage, the majority of which is limited to site preparation and roadside weed control, while insecticides and fungicides are not widely used. In the past, both aerial and ground application techniques have been used. Aerial spraying is on the decline and is not used at all on federal forests. Federal law requires users to follow U.S. EPA labels on the chemical containers (Wisconsin Department of Natural Resources, 1995). On public lands, the implementation of BMPs helps prevent misuse of common chemicals. These BMPs include applying chemicals under favorable weather conditions, calibrating spray equipment to apply chemicals uniformly, using spot-injection spraying in riparian management zones, mixing chemicals away from riparian areas, rinsing equipment in areas that are part of the spray site, and disposing of chemical containers according to label instructions.

During harvesting, antifreeze, fuels, and lubricants associated with heavy equipment are utilized. Any resulting spills are required to be reported to state's Department of Natural Resources. On public lands, the implementation of BMPs helps prevent non-point source pollution from fuels, lubricants, and waste during forest management activities. These BMPs include using biodegradable lubricants whenever practicable, maintaining equipment regularly, designating specific areas for equipment maintenance (i.e., level terrain, away from streams), and collection and storage of hazardous wastes in leak-proof containers.

3.6.5 Geology and Soils

The timber procurement area has a history of glaciation. The topography varies from level, associated with swamps and lakes, to undulating and broken, associated with pitted outwashes and moraines. Most of the area consists of low rolling hills, although some hills are more than 200 feet high. The soils and drainage patterns are typical of a glaciated area. Sand and gravel soils are characteristic of both outwash and till deposits. Loamy and silty soils occur in the glacio-lacustrine and ground morainal systems. Peats and mucks are associated with lowland organic deposits. The abundance of rivers, lakes, and wetlands also is a result of the glacial action. In addition many of the soils in the region are sandy in nature and have low compaction rates and high water permeability potentials. Most soil disturbances within the procurement area caused by timber management activities and recreational development. On public lands, the implementation of BMPs such as road stabilization minimize the impacts from soil erosion.

Most of the bedrock in the timber procurement area is buried by deposits left from the repeated glaciation during the Pleistocene epoch. In a number of places, however, especially in the western Upper Peninsula and along the shores of the Great Lakes in the north, bedrock protrudes through the glacial drift.

3.6.6 Water Resources

Forest and wetlands generally occur where annual precipitation exceeds annual evaporation (Jaakko Poyry Consulting, Inc., 1992). This means there is an excess of water in most forested regions within the procurement area. This excess helps to explain the abundance of lakes, streams, and wetlands in the area. These resources currently experience local impacts during harvesting activities. Wetlands within the procurement area are addressed under Section 3.6.9, Biological Resources.

The climate within the procurement area is temperate with 28 to 32 inches of precipitation annually. Stream rates of flow and volume are highest during snowmelt and early summer, coinciding with precipitation patterns. Due to the low relief and recent glaciation, the streams are not cut deep

enough to cause severe bank instability. However, localized conditions of instability exist. On public lands, the implementation of BMPs helps minimize the effects of forest management activities. These BMPs include building culverts on stream crossings and establishing filter (buffer) strips near water bodies. Implementation of BMPs on private land is voluntary.

Rivers protected under the federal Wild and Scenic Rivers Act within the procurement area include the Pere Marquette and Au Sable in Michigan and the Wolf River in Wisconsin. The use and development of lands along such designated rivers is controlled and regulated by a permit process.

Designated state natural rivers within the Michigan portion of the procurement area include the Fox, Two Hearted, Pigeon, Jordan, Boardman, Rifle, Betsie, and White Rivers. Eighteen other rivers in the procurement area are proposed for designation. All activities within 400 feet of the state designated rivers are regulated through state and local zoning ordinances which protect the unique river values (Michigan Department of Natural Resources, 1994). State designated wild rivers within Wisconsin include the Pike River, Pine River, and the Popple River. Under WAC, timber harvesting is not permitted within 150 feet of the bank on lands owned by or under control of the state. Beyond 150 feet, timber cutting must be done in accordance with guidelines established in the state's silvicultural and forest aesthetics handbook (Wisconsin Department of Natural Resources, 1995).

3.6.7 Air Quality

The timber procurement area is in attainment for all criteria pollutants. Sources of air emissions within the area include motor vehicles, small industrial facilities, and those associated with the forest industry, such as pulp mills and prescribed forest burning. Section 3.4.3, Air Quality, provides a detailed description of the laws and regulations that pertain to air quality. Certain national parks and wilderness areas are designated Class I areas, where appreciable deterioration from new or modified stationary sources in air quality is considered significant. Class II areas are those where moderate, well controlled industrial growth could be permitted. Most of the timber procurement area is considered Class II as designated by the U.S. EPA. The Seney National Wildlife Refuge, 55 miles east of K. I. Sawyer AFB, and Isle Royale National Park in Lake Superior are Class I areas in or near the timber procurement area.

3.6.8 Noise

Noise within the forest in the timber procurement area is generated from several sources, which have varying degrees of intensity and duration. These include motor vehicle use on highways and forest roads, recreational vehicles on trails and traveling across country (e.g., motorcycles), activities associated with camping, seasonal dwellings, firearms during hunting

season, power boats on lakes and streams, snowmobiling, forest management activities, such as timber harvesting and road construction, and low-flying aircraft associated with both public and military uses.

The distance that noise travels varies: 1/4 mile for sounds generated by normal activities around homes and campgrounds; 1 mile for chain saws; 3 miles for diesel trucks traversing hilly terrain; and 20 miles for low-flying aircraft. There are times when these noise levels are objectionable and detract from the quiet kinds of activities or experiences desired by many forest users. What is considered objectionable is dependent on the individual person and the type of activity. Noise effects on wildlife are addressed under Section 3.6.9, Biological Resources.

3.6.9 Biological Resources

Original growth in much of the timber procurement area was burned, cleared during mining operations in the 1840s (particularly in an area of the western Upper Peninsula known as Copper Country), or harvested in the 1880s and 1890s to support the building of cities in the Midwest. There are some remnant stands of original growth, but most of the forested areas contain regrowth.

Vegetation. The procurement area encompasses a variety of habitats that can be broadly grouped into three types of vegetative communities: coniferous forests, deciduous forests, and nonforest. Some of the habitats overlap, such as parts of the Upper Peninsula where coniferous and deciduous forests merge.

Coniferous forest communities are represented by pine forests (red, white, and jack pine) and lowland conifers. Red pine frequently occurs in the form of plantations, some of which were planted in the Lower Peninsula in the early 1900s. In red pine stands less than 60 years old, the variety and number of animal species that are likely to be found are limited due to lack of vegetative variety, coupled with the absence of an understory due to shade and heavy needle accumulation. Where the stands are older and have been thinned, there is better understory formation and, consequently, better habitat structure. White pine forests tend to have a better understory throughout all stages than the red pine. The increase in understory growth, in response to maturing and thinning of the trees, also tends to occur at an earlier age.

Jack pine forests occur mostly on dry sandy plains and low sandy hills. Growth may vary from areas with pure jack pine to areas of jack pine mixed with oak, aspen, cherry, and other pines. Natural jack pine stands vary in density from sparse to very dense and include a varied ground cover of grasses, forbs, and low shrubs. Food availability and the vegetative structure of jack pine areas provide suitable habitat for a large population of

wildlife, including deer, hare, spruce grouse, and pine warbler. Young and intermediate age stands of jack pine are the preferred habitat of the endangered Kirtland's warbler.

Lowland coniferous forests are dominated by northern white cedar, hemlock, tamarack, and balsam fir. Young stands, particularly where cedar is found, are preferred by deer for winter browse and also provide food and cover for spruce grouse, bobcat, and hare. As the trees mature, the branches grow out of reach of browsing deer but, where the canopy is dense, they provide good thermal cover for wintering deer and nesting habitat for various birds including the blackburnian warbler, northern three-toed warbler, and black-throated green warbler. Later, as they become overmature, these stands begin to lose their value as thermal cover. Forests of this type can be difficult to regenerate because browsing by deer tends to limit the height of new growth.

Deciduous forests include aspen/birch, northern hardwood, and lowland hardwood areas. The overstory in the aspen forest can range from stands composed entirely of aspen to mixtures of aspen with red maple and/or balsam fir where more moisture is available, or to aspen with oak and/or pines on drier sites. Young stands of aspen provide leafy browse for deer.

Northern hardwood (beech/maple and oak) forests are typically found on morainal hills (glacier deposition) and dry sandy plains and hills. Young stands provide moderate to dense ground cover and understory which, in turn, provides escape cover and nesting habitat. Older stands provide food and habitat for mast (e.g., acorn) eating animals, such as squirrel, turkey, deer, blue jays, woodpeckers, and many other species. Older trees also provide cavities, used as shelter by some animals. Lowland hardwoods, similar to northern hardwoods, are more diverse with a more prevalent and varied ground cover. This forest type ranges from elm-ash in standing water to red maples on drier sites.

Wildlife. A variety of birds inhabit mature or old growth stands; pileated woodpeckers are considered representative of well stocked, mature or overmature forests where there are large snag trees. The barred owl nests in large canopy trees and in snags with large cavities. Downy woodpeckers are found in all timber types where there are small snag trees. The ovenbird is associated with all mature, long-rotation, old growth and uneven aged timber stands.

Other animals are more indicative of younger forest areas. The Lincoln's sparrow prefers areas of young, regenerating conifers; the song sparrow is most often found in young clearcut stands; and the black bear prefers forested areas well interspersed with early stages of forest succession.

Nonforest areas include grass/forb openings, shrub openings, savannah/orchard, and pasture/old fields. Openings in a forested environment are a very important habitat element for many wildlife species and provide forage for deer and other species; berries and seeds for birds; singing and roosting grounds for woodcock; and gathering places for other species. Larger openings are used by grassland and grassland/woodland edge species, such as bluebirds, field sparrows, and flickers. Nonforest areas also include wetlands and water (lakes, streams, rivers, and riparian areas).

Threatened and Endangered Species. Threatened, endangered, and species of concern in the counties within the proposed timber harvesting area are listed in Appendix K, Table K-2, as provided by the MDNR and WDNR. Included on the list are several species that may be present within the forested areas where timber harvesting could occur. The federal and state species listed as threatened and endangered that have been considered noteworthy in U.S. Forest Service Land Management EISs are discussed below.

Kirtland's warbler (*Dendroica kirtlandii*) is federally and Michigan state listed as endangered. The birds return to Michigan in the spring (after wintering in the Bahamas) and nest in young jack pine stands found on dry sandy plains. The Lower Peninsula is the only area where this species is known to nest.

Bald eagles (*Haliaeetus leucocephalus*) are federally and state listed as threatened. Numerous known nesting areas are within the procurement area; for example, there are 11 nesting territories within the Huron and Manistee national forests, Michigan, and 19 within the Nicolet National Forest, Wisconsin. Bald eagles generally nest in tall, old growth trees that are near water bodies with productive fisheries.

Peregrine falcons (*Falco peregrinus*) are listed as endangered by the federal government and the states of Michigan and Wisconsin. They are found only as a migrant in the spring and possibly in the fall. Osprey (*Pandion haliaetus*) are Michigan state listed as threatened. Their habitat requirements are similar to those of the bald eagle, and known nesting territories exist in the Upper Peninsula, mainly along Pictured Rocks National Lake Shore.

The gray wolf (*Canis lupus*) is federally listed as endangered in part of its range and threatened in the rest of its range; it is state listed by both Michigan and Wisconsin as endangered, and efforts to restore populations are under way. An attempt to reintroduce four wolves in the Upper Peninsula in 1974 was unsuccessful; other measures, such as establishing undisturbed habitat areas, are under consideration. Occasional sightings of the animals or their sign within the proposed timber procurement area have been documented.

The karner blue butterfly (*Lycaeides melissa samuelis*) is federally listed as endangered and Michigan listed as threatened. In Wisconsin the species is considered a species of special concern and is found in Oconto, Shawano, and Menominee counties. This butterfly prefers prairie, oak savanna, and jack pine habitats with wild lupines.

Pine martens (*Martes americana*) are Michigan state listed as endangered and Wisconsin state listed as threatened. Once extirpated throughout the region, the pine marten has been successfully reintroduced in the Upper Peninsula and is also being reintroduced in the northern portion of the Lower Peninsula. Preferred marten habitat is mature stands of hardwoods mixed with conifers, especially hemlock.

Sensitive fish species include the lake sturgeon (*Acipenser fulvescens*), a candidate species for federal listing, state listed by Michigan as threatened, and protected in Wisconsin. Once abundant, the lake sturgeon is now considered rare throughout its range. Its decline in numbers has been attributed to obstruction of traditional spawning waters by dams, over exploitation, and water pollution. Other fish species include the greater redhorse (*Moxostoma valenciennesi*), state listed in Wisconsin as threatened; channel darter (*Percina copelandii*), state listed in Michigan as threatened; and river redhorse (*Moxostoma carinatum*), listed in both states as threatened.

Sensitive Habitat. Sensitive habitats within the procurement area include wetlands, plant communities that are unusual or of limited distribution, and important seasonal use areas for wildlife. The regulations that pertain to wetlands and sensitive habitats are addressed in Section 3.6.1.3, Timber Ownership in the Procurement Area.

Wetland areas are found in abundance throughout the proposed timber procurement area. In the Nicolet National Forest alone there are 1,160 lakes (covering 42,000 acres), over 1,100 miles of streams, and over 400 natural spring ponds. When other wetland types, such as sedge meadow, marsh, shrub swamp, and bog, are included, wetlands account for approximately 153,000 acres (23 percent) of that National Forest. Similar types of wetland areas are found in the remainder of the procurement area. In addition to nonforested wetland areas, forested wetlands may be present. Forested wetland areas in the region are dominated by lowland conifers and swamp hardwoods.

Other sensitive habitats include those riparian zones that support an abundance of the threatened and endangered species, such as the narrow-leafed gentian or bald eagle. Sensitive habitats also include those areas that support wide-ranging species, such as the endangered gray wolf.

3.6.10 Cultural Resources

The earliest archaeological sites in the procurement area date to the time following the recession of glacial ice. Since that time, transitions in environment and the lifestyle of the people have occurred. The cultures of many peoples from Paleo-Indian hunters through woodland farmers to the period of written history (represented by traders, loggers, and settlers) may be represented on sites within the procurement area. Section 3.4.6, Cultural Resources, provides a more detailed description of the laws and regulations that pertain to cultural resources.

Within the procurement area most prehistoric sites can be found along lake shorelines and stream banks and riverbanks. Few inland sites have been discovered. Historic sites, such as logging and trader camps, can be found throughout the timber procurement area. Based on information provided by the Michigan SHPO, the average site density consists of 1.1 site per 640 acres for the western Upper Peninsula, 1.5 sites per 640 acres for the eastern Upper Peninsula, and between 2.9 and 4.3 sites per 640 acres for the upper Lower Peninsula. The actual density of sites is based on existing survey information. Those areas, such as the western Upper Peninsula, which has had few surveys, will have a lower density than those areas where more surveys and ground-disturbing activities have identified significant sites. In the Ottawa National Forest in the western Upper Peninsula, where over 60 percent of the area has been surveyed, site density is two sites per 640 acres which is a higher site density than for all of the western Upper Peninsula. Data gathered for northeast Wisconsin showed site density of less than one site per 640 acres.

Forest activities on federal lands are managed in accordance with the NHPA, which requires the identification of cultural resources prior to a federal undertaking. Prior to timber sales, areas within federal lands with a high potential for cultural resources are surveyed. For instance, in the Hiawatha National Forest, approximately 600,000 acres have been reviewed for cultural resources. In this forest the average density for prehistoric sites is one per 1,500 acres and for historic sites is one per 300 acres. For prehistoric sites the density in the Hiawatha National Forest is greatest for areas along lake shores and streams. Because the NHPA applies only to federal undertakings, few if any surveys to identify cultural resources on state and private land have taken place.

3.7 ENVIRONMENTAL JUSTICE

3.7.1 Background

Executive Order 12898, Environmental Justice, was issued by the President on February 11, 1994. Objectives of the Executive Order as it pertains to this reuse and disposal document include development of federal agency

implementation strategies, identification of low-income and minority populations potentially impacted because of proposed federal actions, and participation of low-income and minority populations. Accompanying Executive Order 12898 was a Presidential Transmittal Memorandum which referenced existing federal statutes and regulations to be used in conjunction with Executive Order 12898. One of the items in this memorandum was the use of the policies and procedures of the NEPA. Specifically, the memorandum indicates that, "Each Federal agency shall analyze the environmental effects, including human health, economic and social effects, of Federal actions, including effects on minority communities and low-income communities, when such analysis is required by the NEPA 42 U.S.C. section 4321 et. seq."

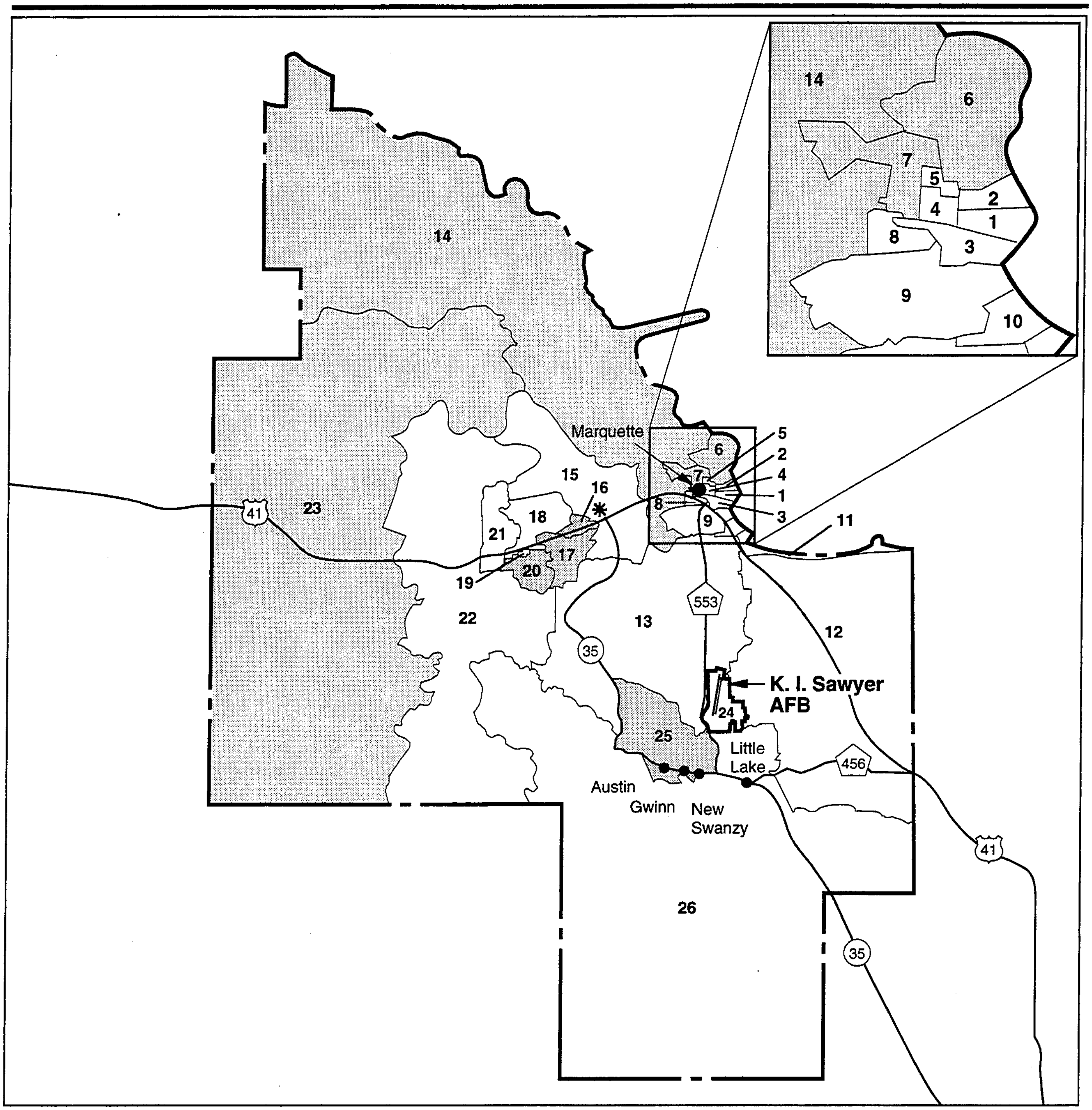
Please note that Environmental Justice is not a legal part of NEPA nor this document as an Executive Order and any attachment documents can neither amend a federal statute nor its implementing regulations. However, an Environmental Justice analysis is included in this document as the latter is the most logical place to consider existing Environmental Justice conditions and possible impacts from reuse and disposal.

Also please note the Environmental Justice information presented in the Draft EIS is the best available as of date of commitment to publication. The collection and analysis of Environmental Justice information for this document is a work in progress, amidst still-developing federal and DOD policies on how such analyses should be handled. What is presented here is not necessarily in the form or with all the content which will be contained in the Final EIS. Comments on this Environmental Justice analysis, as on other aspects of the Draft EIS, are solicited during the public comment period.

3.7.2 Demographic Analysis

The demographic analysis provides information on the approximate locations of low-income and minority populations in the area potentially affected by the disposal and reuse of K. I. Sawyer AFB. Although the ROI for population and economic effects consists of Marquette and Delta counties, most environmental impacts from disposal and reuse would occur within Marquette County. In developing statistics for the 1990 Census of Population and Housing, the U.S. Department of Commerce, Bureau of the Census has identified small subdivisions used to group statistical census data. In metropolitan areas, these subdivisions are known as Census Tracts, while in non-metropolitan areas, they are referred to as Block Numbering Areas (BNAs). For Marquette County, BNAs are used. Figure 3.7-1 shows the BNAs within Marquette County, and the individual BNAs shown lie wholly located within the boundary of the county.

Tables from the 1990 Census of Population and Housing were used to extract data on low-income and minority populations within the BNAs in



EXPLANATION

Base Boundary

BNAs

Minority/Low-Income Population

Marquette County (Region of Comparison)

456 County Road (CR)

35 State Highway

41 U.S. Highway

✱ Marquette County Airport

0 2.5 5 10 Miles

K. I. Sawyer AFB/ Marquette County Minority/Low-Income BNAs

Figure 3.7-1

Marquette County. The census reports both minority and poverty status. Minority populations included in the census are identified as Black; American Indian, Eskimo or Aleut; Asian or Pacific Islander; Hispanic; or other. Poverty status (used in this EIS to define low-income status) is reported as the number of families above or below poverty level ($12,764 for a family of four in 1989, as reported in the 1990 Census of Population and Housing).

In order to determine whether an individual BNA contains a disproportionate low-income or minority population, a comparison was made between the individual BNA and the regional political jurisdiction surrounding that BNA. For this analysis, this region of comparison (ROC) is defined as Marquette County. The environmental impact analysis indicates that all potential impacts would occur within Marquette County. Based upon the 1990 Census of Population and Housing, Marquette County had a population of 72,669 persons. Of this total, 8,477 persons, or 12.90 percent, were low income, and 3,056 persons, or 4.21 percent, were minority.

Marquette County is subdivided into 26 BNAs, of which 8 (BNA 6, 7, 14, 16, 17, 20, 23, and 25) have a higher percentage of low-income or minority population than the county as a whole (see Figure 3.7-1). These BNAs have been determined to have disproportionate low-income and/or minority populations, and therefore may be subject to environmental justice impacts.

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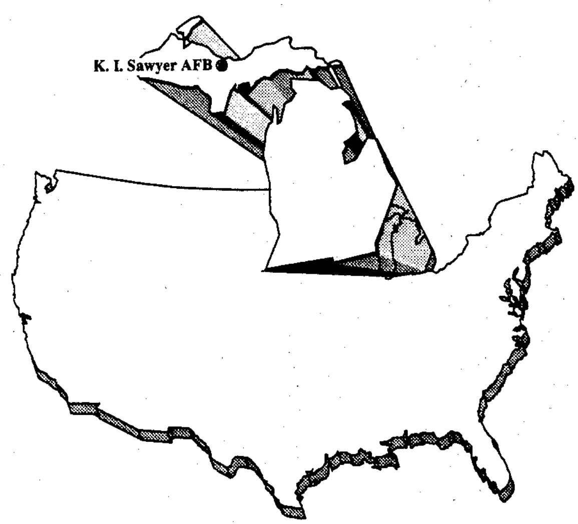


CHAPTER 4
ENVIRONMENTAL CONSEQUENCES

4.0 ENVIRONMENTAL CONSEQUENCES

4.1 INTRODUCTION

This chapter discusses the potential environmental consequences associated with the alternatives. To provide the context in which potential environmental impacts may occur, discussions of potential changes to the local communities, including population, land use and aesthetics, transportation, and community and public utility services are included in this section. In addition, issues related to current and future management of hazardous materials and wastes are discussed. Impacts to the physical and natural environment are evaluated for geology and soils, water resources, air quality, noise, biological resources, and cultural resources. These impacts may occur as a direct result of disposal and reuse activities or as an indirect result caused by changes within the local communities. This chapter also provided an analysis of Environmental Justice. Possible mitigation measures to minimize or eliminate the adverse environmental impacts are also presented.

Cumulative impacts result from "the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time" (Council on Environmental Quality, 1978). Under the reuse alternatives, there is the potential that Marquette County Airport operations could be relocated to K. I. Sawyer AFB, leaving the county airport property available for reuse. Because Marquette County Airport is approximately 17 miles from K. I. Sawyer AFB, none of the ROIs for the resources addressed in this EIS affect the same geographical area except for air quality. Neither the reuse of K. I. Sawyer AFB or Marquette County Airport are expected to individually or cumulatively affect the attainment status or air quality standards within the ROI. Because no potential cumulative impacts have been identified, cumulative impacts are not addressed in the following sections.

Means of mitigating substantial adverse environmental impacts that may result from implementation of the alternatives by property recipients are discussed as required by NEPA. Potential mitigation measures are described for those components likely to experience substantial and adverse changes under any or all of these alternatives. Potential mitigation measures depend upon the particular resource affected. In general, however, mitigation measures are defined in CEQ regulations as actions that include:

(a) Avoiding the impact altogether by not taking an action or certain aspect of the action

(b) Minimizing impacts by limiting the degree or magnitude of the action and its implementation

(c) Rectifying the impact by repairing, rehabilitating, or restoring the affected environment

(d) Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action

(e) Compensating for the impact by replacing or providing substitute resources or environments.

Mitigation measures that are clearly required by law or standard industry practices are generally considered to be part of the Proposed Action or alternatives and are taken into account in the description of impacts projected for each resource area. Additional potential mitigation measures beyond those clearly required by law or standard practices are described for each resource area where appropriate. Such measures include those the Air Force could implement, those the property recipients could implement, those discretionary mitigations or choices available to other governmental bodies (such as zoning, permit conditions, etc.), or lease and deed restrictions available to a possible primary recipient of the property, such as the redevelopment authority.

For each resource area, suggested actions to mitigate substantial adverse environmental impacts will be described as follows, to the extent applicable:

- A reasonable selection of feasible alternative mitigative actions will be identified and described.

- The benefits derived from each of the alternative mitigations to the environmental impact will be described.

- The burdens/costs associated with each of the mitigations will be described.

- The effectiveness and probability of adoption for each of the mitigations will be described.

- The party(ies) that could implement and enforce, if applicable, each action will be identified, especially non-Air Force entities.

The Air Force will identify zoning and permitting, contracting, and other legal authorities and mechanisms for implementing mitigations.

Since most potential environmental impacts would result directly from the reuse by others, full responsibility for these suggested mitigations would generally be borne by future property recipients or local government agencies. However, the Air Force may place specific restrictions in leases or covenants in deeds that would limit the use of the property, alert transfers

to special concerns or legal requirements, or provide for notice and reporting demands before taking actions affecting the property.

Alternatives are defined for this analysis on the basis of (1) plans of local communities and interested individuals, (2) general land use planning considerations, and (3) Air Force-generated plans to provide a broad range of reuse options. Reuse scenarios considered in this EIS must be sufficiently detailed to permit environmental analysis. Initial concepts and plans are taken as starting points for analysis of scenarios. Available information on any reuse alternative is then supplemented with economic, demographic, transportation, and other planning data to provide a reuse scenario for analysis.

4.2 LOCAL COMMUNITY

This section discusses potential effects on local communities as a result of disposal and reuse of K. I. Sawyer AFB.

4.2.1 Community Setting

Socioeconomic effects will be addressed only to the extent that they are interrelated with the biophysical environment. A complete assessment of socioeconomic effects is presented in the Socioeconomic Impact Analysis Study for Disposal of K. I. Sawyer Air Force Base, Michigan. Employment and population generated by the implementation of the Proposed Action and each alternative are discussed herein. The closure baseline projects employment levels of 50 direct and 13 secondary jobs for 1995 to remain constant through 2015 for the No-Action Alternative. ROI population for the closure baseline and post-closure are estimated to be 103,322 for 1995 and 114,895 for 2015. This represents an increase of approximately 11,573, or 0.5 percent per year.

This analysis recognizes the potential for community impacts arising from "announcement effects" stemming from information regarding the base's closure or reuse. Such announcements may impact community perceptions and, in turn, could have important local economic effects. An example would be the in-migration of people anticipating employment under one of the reuse options. If it were later announced that the No-Action Alternative was chosen, many of the newcomers would leave the area to seek employment elsewhere. Such an effect could, therefore, result in an initial, temporary increase in population followed by a decline in population as people leave the area.

4.2.1.1 Proposed Action. Reuse of K. I. Sawyer AFB under the Proposed Action would generate 17,303 (9,853 direct and 7,450 secondary) jobs by 2015 compared to 50 direct jobs and 13 secondary jobs projected under the No-Action Alternative. Direct jobs would be located on base property and

secondary jobs would be created throughout the ROI. Approximately 30 percent of direct jobs and 5 percent of the secondary jobs are projected to be filled by in-migrating workers. Total employment in the ROI would be 81,368 in 2015 under the Proposed Action, an increase of 27 percent over No-Action Alternative projections for that year. ROI reuse-related employment growth is projected to average 2.2 percent annually between closure and 2015. Figure 4.2-1 shows the effects of the Proposed Action on employment levels in the ROI.

Population in the ROI would increase by 10,483 from closure to 2015 as a result of new employment generated by the Proposed Action (Figure 4.2-2). Thus, ROI population is expected to increase by an average of 1 percent per year between closure and 2015, to a total of 125,378; this figure represents an increase of 9 percent over No-Action Alternative projections for this year. Most of the in-migrants are expected to locate in Forsyth Township and in the city of Marquette.

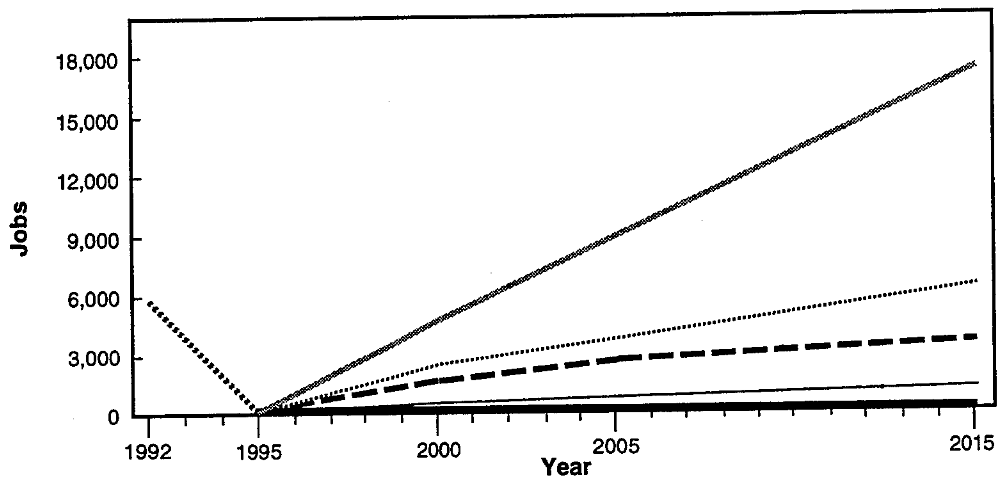
4.2.1.2 International Wayport Alternative. Reuse activities at K. I. Sawyer AFB under the International Wayport Alternative would generate 6,372 (3,844 direct and 2,528 secondary) jobs by 2015 (Figure 4.2-1) compared to 50 direct jobs and 13 secondary jobs projected under the No-Action Alternative. Approximately 30 percent of direct jobs and 5 percent of the secondary jobs are projected to be filled by in-migrating workers. Total employment in the ROI would be 70,437 in 2015 under the International Wayport Alternative, an increase of 10 percent over No-Action Alternative projections for that year. ROI reuse-related employment growth is projected to average 1.4 percent annually between closure and 2015.

Population in the ROI would increase by 4,056 from closure to 2015 as a result of new employment generated by the International Wayport Alternative (Figure 4.2-2). Thus, ROI population is expected to increase by an average of 0.7 percent per year between closure and 2015, to a total of 118,951; this figure represents an increase of almost 4 percent over No-Action Alternative projections for that year. The geographic distribution of employment and population growth would be similar to that discussed for the Proposed Action.

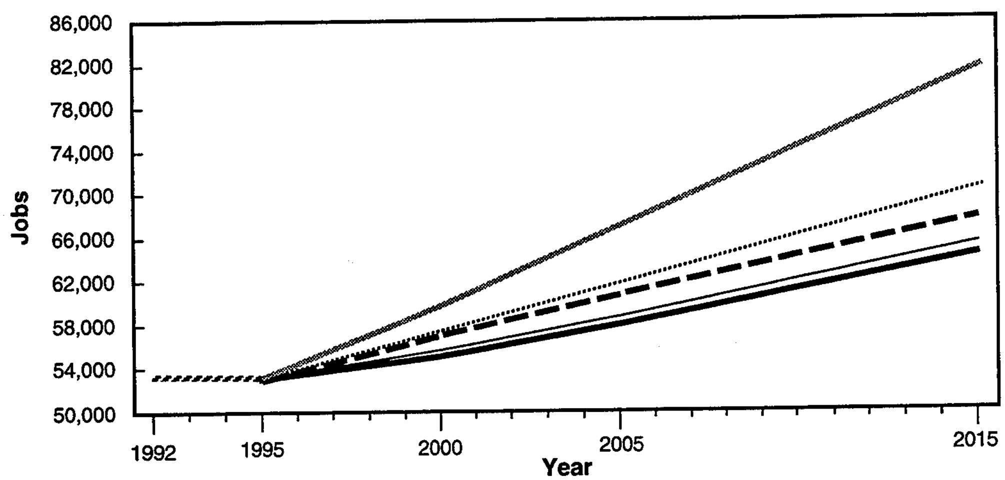
4.2.1.3 Commercial Aviation Alternative. Reuse of the base under this alternative would generate 3,542 (2,176 direct and 1,366 secondary) jobs in the ROI by 2015 (see Figure 4.2-1) compared to 50 direct jobs and 13 secondary jobs under the No-Action Alternative. Approximately 30 percent of direct jobs and 5 percent of secondary jobs are projected to be filled by in-migrating workers. Total employment in the ROI would be 67,607 by 2015 under this alternative, an increase of 6 percent over the No-Action Alternative projections for that year. ROI employment growth is projected to average 1.2 percent per year between closure and 2015. The geographic

ALTERNATIVE	1995 (a)	2000	2005	2015
Proposed Action	63	4,654	8,871	17,303
International Wayport Alternative	63	2,448	3,867	6,372
Commercial Aviation Alternative	63	1,738	2,743	3,542
Recreation Alternative	63	509	829	1,176

Reuse-Related Employment Effects (b)



Reuse-Related Employment Effects (b)



Total Region of Influence (ROI) Employment Including Reuse Effects

EXPLANATION

- Preclosure
- Proposed Action
- International Wayport Alternative
- Commercial Aviation Alternative
- Recreation Alternative
- No-Action Alternative

(a) The 1995 values represent total base-related employment under the closure baseline.

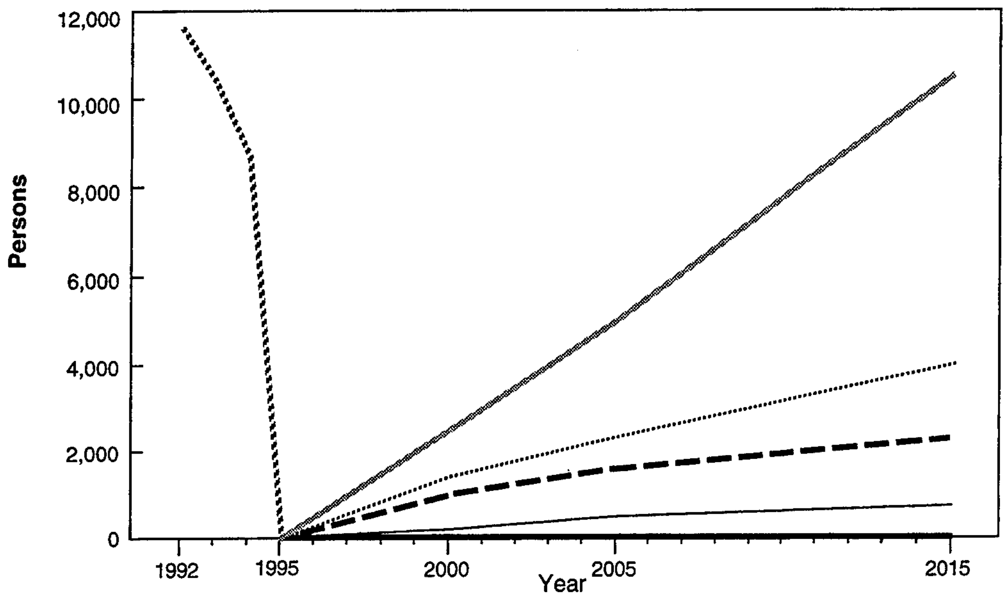
(b) Employment effects include both direct and secondary employment and represent the change in employment relative to the No-Action Alternative.

Reuse-Related Employment Effects

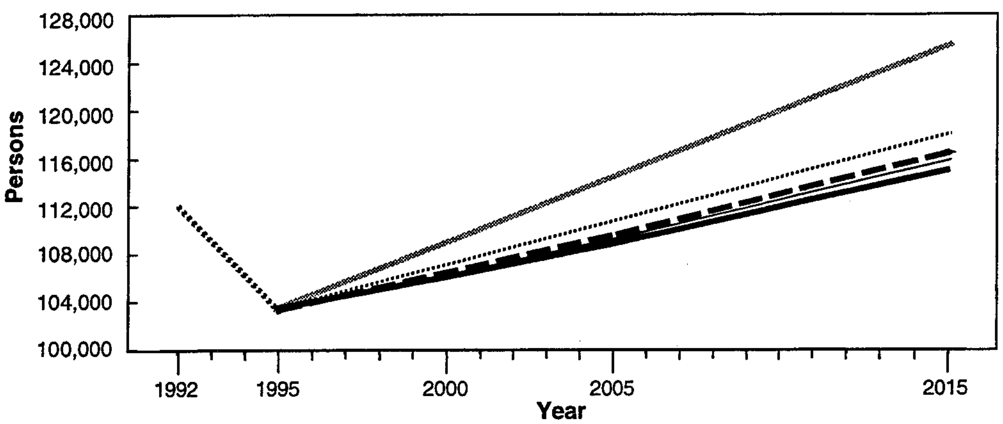
Figure 4.2-1

ALTERNATIVE	1995	2000	2005	2015
Proposed Action	0	2,528	5,014	10,483
International Wayport Alternative	0	1,411	2,309	4,056
Commercial Aviation Alternative	0	995	1,645	2,301
Recreation Alternative	0	351	592	863

Reuse-Related Population Effects



Reuse-Related Population Effects



Total ROI Population Including Reuse

EXPLANATION

- Preclosure
- Proposed Action
- International Wayport Alternative
- Commercial Aviation Alternative
- Recreation Alternative
- No-Action Alternative

Reuse-Related Population Effects

Note: 1995 represents closure conditions. Reuse-related population effects are the persons that would move into the ROI solely as a result of reuse.

Figure 4.2-2

distribution of employment and population growth would be similar to that discussed for the Proposed Action.

Population in the ROI is projected to increase by 2,301 persons between closure and 2015 as a result of this alternative (see Figure 4.2-2), an average annual rate of growth of 0.6 percent. Total population in the ROI in 2015 would reach 117,196 under this alternative, an increase of 2 percent over the No-Action Alternative projection for that year.

4.2.1.4 Recreation Alternative. Reuse of the base under the Recreation Alternative would generate 1,176 (806 direct and 370 secondary) jobs in the ROI by 2015 (see Figure 4.2-1) compared to 50 direct jobs and 13 secondary jobs under the No-Action Alternative. Approximately 32 percent of direct jobs and 5 percent of secondary jobs are projected to be filled by in-migrating workers. Total employment in the ROI would be 65,241 by 2015 under this alternative, an increase of 2 percent over the No-Action Alternative projection for that year. ROI employment growth is projected to average 1 percent per year between closure and 2015. The geographic distribution of employment and population growth would be similar to that discussed for the Proposed Action.

Population in the ROI is projected to increase by 863 persons between closure and 2015 as a result of this alternative (see Figure 4.2-2), an average annual rate of growth of 0.6 percent. Total population in the ROI in 2015 would reach 115,758 under this alternative, an increase of 0.8 percent over the No-Action Alternative projection for that year.

4.2.1.5 No-Action Alternative. Under the No-Action Alternative, only caretaker status activities would occur at the base. It is estimated that the caretaker activities at K. I. Sawyer AFB would maintain approximately 50 direct and 13 secondary jobs in Marquette and Delta counties through 2015. There would be no net increase in population as a result of the No-Action Alternative. By 2015, total population in the ROI is expected to be 114,895 and employment 64,065.

4.2.1.6 Other Land Use Concepts. The independent land use concepts would be initiated on an individual basis and not as part of any integrated reuse alternatives. The potential effects of these independent land use concepts are discussed in relation to their effects on the alternatives. The net increase or decrease in employment described below is based on which land uses under the Proposed Action and alternatives would be replaced by the land use concept.

Michigan Army National Guard. The MANG has requested the use of portions of the base as a headquarters for the 107th Combat Engineering Battalion. Activities would involve an average of 30 weekend drills per year. Direct employment for this land use concept is estimated at 50 full-time

employees. The area requested for this proposal would increase the number of direct employees by 13 under the International Wayport Alternative, and by 43 under the Recreation Alternative, and decrease the number of employees by 59 under the Commercial Aviation Alternative. This proposal would not affect the Proposed Action because this concept was included within the community's reuse plan.

Correctional Institution. The correctional institution would include approximately 273 acres in the northwest portion of the base for development of a maximum security correctional facility. Direct employment is estimated at 250 full-time employees. This represents a reduction of 1,600 direct employees from the Proposed Action reuse of the same area. Under the other alternatives direct employment would increase by 250.

Sawmill. Direct employment for this land use concept is estimated at 90 full-time employees. Implementation of this concept in conjunction with the reuse alternatives would result in a net reduction in direct employment of 120 under the Proposed Action and a net increase in employment of 28 under the International Wayport Alternative, 72 under the Commercial Aviation Alternative, and 89 under the Recreation Alternative.

Waste to Energy/Recycling. Direct employment for this land use concept is estimated at 50 full-time employees. Implementation of this concept in conjunction with the reuse alternatives would result in a net reduction in direct employment of approximately 80 under the Proposed Action and alternatives.

Waste to Energy/Environmental Support Operations. Direct employment for this land use concept is estimated at 100 full-time employees. Implementation of this concept in conjunction with the reuse alternatives would result in a net reduction in direct employment of 49 under the Proposed Action, 184 under the International Wayport Alternative, 84 under the Commercial Aviation Alternative, and 131 under the Recreation Alternative.

4.2.2 Land Use and Aesthetics

This section discusses the alternatives relative to land use and zoning to determine potential impacts in terms of general plans, zoning, land use, and aesthetics. Land use compatibility with aircraft noise is discussed in Section 4.4.4.

4.2.2.1 Proposed Action

Comprehensive Plans. Since Sands Township does not have a comprehensive plan, the Marquette County comprehensive plan has been utilized as the township's planning guide for land use analysis. The county

plan advocates concentrated development and consideration of noise and safety policies for development in the vicinity of the base.

The Forsyth Township comprehensive plan provides for maintenance of open space, and the West Branch Township plan advocates natural resources development with residential development around lakes east of the base. Both townships discourage development within aircraft noise contours associated with K. I. Sawyer AFB.

Civilian development of the base under the Proposed Action would require modification of the comprehensive plans and the proposed land uses within the individual jurisdictions. Therefore, it is likely that Marquette County and Forsyth Township would update their comprehensive plans to include the proposed airfield, aviation support, and associated uses. West Branch Township would update its comprehensive plan for the proposed industrial, institutional (educational), and residential uses.

Zoning. The zoning ordinances of Sands, Forsyth, and West Branch townships would be applicable when the base property is conveyed to private ownership. Under the Proposed Action, airfield, industrial, institutional (educational), and residential use of the base property within Forsyth and West Branch townships would not be consistent with the zoning for public use of these areas. Therefore, it is likely that these townships would rezone the property to be consistent with the Proposed Action. The proposed airfield, aviation support, industrial, institutional (medical), commercial, public facilities/recreation, and military uses would be consistent with the zoning for Sands Township.

Land Use. The Proposed Action would result in increases in the airfield, aviation support, industrial, and public facilities/recreation land uses, and decreases in the institutional (educational), commercial, and residential land uses over preclosure conditions. In addition, military use of 193 acres would occur on the west side of the airfield, and the preclosure land use designation of agriculture (forest) would be eliminated. The institutional (medical) land use would be consistent with the proposed reuse of the base hospital.

Changes in the land uses associated with the Proposed Action include conversion of existing aviation support, institutional (educational), and agricultural (forest) land to military uses by the MANG and U.S. Army Reserve. Aviation support, industrial, institutional (educational), and public facilities/recreation land uses would be converted for the expansion of the airfield. Aviation support, institutional (educational), commercial, residential, public facilities/recreation, and agricultural (forest) land uses would be converted to industrial development throughout the base. Aviation support, industrial, commercial, residential, and agricultural (forest) land uses would be converted to public facilities/recreation land uses. In addition, minor land

use changes would occur to incorporate aviation support, institutional (educational), and commercial parcels throughout the base.

Aesthetics. Under the Proposed Action, the high visual sensitivity area along Silver Lead Creek and the golf course would remain unchanged from preclosure conditions. However, an area north of the family housing area that exhibits a high visual sensitivity would be developed for heavy industrial use.

Compared to other alternatives, the Proposed Action could result in visual impacts to adjacent land with the conversion of 75 percent of the base to the more developed uses, such as industrial, and only 25 percent of the base remaining in the largely undeveloped public facilities/recreation land use.

Mitigation Measures. The industrial uses in the eastern portion of the base could be sited so they are visually buffered from the retained on-base residences and the off-base residential uses to the east. The aviation support and industrial development west of the airfield could also be visually buffered from CR 553. The property recipient could use fencing or landscaping, such as shrubs or trees, or a combination of these items when siting facilities. The actual effectiveness and cost of these mitigations would depend on the type of fencing or landscaping used. Typically, the use of large trees has been found most effective in buffering large industrial facilities from other incompatible uses, while fences and small shrubs have been effective in buffering smaller industrial complexes. Depending on the type of industrial area developed at K. I. Sawyer AFB, a combination of this type of buffering could be utilized. The use of indigenous conifers may be the most effective means of buffering industrial areas from residential areas.

4.2.2.2 International Wayport Alternative

Comprehensive Plans. As under the Proposed Action, local comprehensive plans and policies would become applicable with reuse of the base. The International Wayport Alternative would require modification of the comprehensive plans of the local townships and the county. Therefore, it is likely that Marquette County and Forsyth Township would update their comprehensive plans to include the proposed airfield, aviation support, and associated uses. West Branch would update its comprehensive plan for the proposed residential and commercial uses.

Zoning. As under the Proposed Action, the zoning ordinances of Sands, Forsyth, and West Branch townships would be applicable when the base property is conveyed to private ownership. Under the International Wayport Alternative, the proposed airfield, aviation support, industrial, institutional, commercial, and residential uses would not be consistent with the zoning for public uses within Forsyth and West Branch townships. Therefore, it is

likely that these townships would rezone the property to these uses. The proposed airfield, aviation support, industrial, institutional (medical and educational), commercial, residential, public facilities/recreation, and agricultural (forest) uses would be consistent with Sands Township zoning.

Land Use. The International Wayport Alternative would result in increases in the aviation support, industrial, institutional (medical and educational), and public facilities/recreation land uses; while the airfield, commercial, residential, and agricultural (forest) land uses would decrease.

Changes in the land uses associated with the International Wayport Alternative include conversion of individual industrial and institutional (educational) sites to agricultural use in the northern portion of the base. East of the airfield, commercial and industrial uses would be converted to aviation support. Portions of the agricultural (forest) land south and west of the airfield would be converted to public facilities/recreation use. Residential and commercial uses would be converted to institutional (educational) in the central and southern portion of K. I. Sawyer AFB.

The proposed land uses are generally compatible with the existing land uses surrounding the base, since the urban on-base land uses are generally buffered by agricultural (forest) and public facilities/recreation lands. The residential land use in the southeastern portion of the base would be compatible with the existing residential development around the lakes east of the base.

Aesthetics. Under the International Wayport Alternative, the high visual sensitivity area along Silver Lead Creek and the golf course would remain unchanged from closure baseline conditions.

Mitigation Measures. No substantial adverse environmental impacts are anticipated under this alternative; therefore, no mitigation measures are required.

4.2.2.3 Commercial Aviation Alternative

Comprehensive Plans. As under the Proposed Action, local comprehensive plans would be applicable under reuse. The Commercial Aviation Alternative would require modification of the comprehensive plans of the local townships and the county. Therefore, it is likely that Marquette County and Forsyth Township would update their comprehensive plans to include the proposed airfield, aviation support, and associated uses. West Branch Township would update its comprehensive plan for the proposed institutional (educational) and residential land uses.

Zoning. As under the Proposed Action, local zoning of the townships would be applicable when the base property is conveyed to private ownership. The proposed airfield, aviation support, industrial, institutional (educational), and

residential uses proposed in the Commercial Aviation Alternative would not be consistent with the zoning for public uses within Forsyth and West Branch townships. Therefore, it is likely that these townships would rezone the property to be compatible with these uses. The proposed airfield, aviation support, industrial, institutional (educational), commercial, and public facilities/recreation land uses would be consistent with Sands Township zoning.

Land Use. The Commercial Aviation Alternative would result in increases in aviation support, industrial, institutional (educational), and public facilities/recreation land uses. Commercial, airfield, residential, and agricultural land uses would be reduced.

Land use changes associated with the Commercial Aviation Alternative in the northern half of the base would include conversion to agriculture, including the airfield, for timber production. In the southern half of the base, the alert apron southwest of the airfield would be converted to industrial land use. In addition, two residential uses would remain the same as preclosure; the other residential areas would be converted to public facilities/recreation and institutional (educational). In the central portion of the base, the industrial and public facilities/recreation uses would be converted to institutional (educational).

The proposed land uses would be compatible with existing adjacent land uses since the on-base urban uses are generally buffered by agricultural (forest) and public facilities/recreation lands.

Aesthetics. Under the Commercial Aviation Alternative, the high visual sensitivity area along Silver Lead Creek and the golf course would remain unchanged from closure baseline conditions.

Mitigation Measures. No substantial adverse environmental impacts are anticipated under this alternative; therefore, no mitigation measures are required.

4.2.2.4 Recreation Alternative

Comprehensive Plans. As under the Proposed Action, local comprehensive plans would be applicable under reuse of the base property. The land uses proposed under the Recreation Alternative are generally consistent with the comprehensive plans of the local townships. However, it is likely that Marquette County and Forsyth Township would update their comprehensive plans to include the reuse development centrally located on base. West Branch would not need to modify its comprehensive plan for this alternative.

Zoning. As under the Proposed Action, the zoning of the townships would be applicable when the base property is conveyed to private ownership. The

industrial and residential land uses proposed in the Recreation Alternative would not be consistent with the public use zoning within Forsyth Township. Therefore, it is likely that Forsyth Township would rezone the property to be compatible with this use. The proposed industrial, institutional (educational), commercial, residential, and public facilities/recreation land uses would be consistent with the Sands and West Branch townships zoning.

Land Use. The Recreation Alternative would result in decreases in existing commercial and residential land uses; while the industrial, institutional (educational), and public facilities/recreation land uses would increase. Airfield, aviation support, institutional (medical), and agricultural (timber production) uses would be eliminated.

Changes in land uses associated with the Recreation Alternative would include conversion of airfield and aviation support land uses to industrial and public facilities/recreation. The flightline and Alert Complex would be converted to industrial use. The residential uses in the southeastern portion of the base would be converted to public facilities/recreation. The Weapons Storage Area and the surrounding agricultural (forest) area would be converted to public facilities/recreation land use.

The proposed land uses would be compatible with existing adjacent land uses, since generally public facilities/recreation uses are proposed at the perimeter of the base.

Aesthetics. Under the Recreation Alternative, the high visual sensitivity area along Silver Lead Creek and the golf course would be preserved in its natural state as public facilities/recreation land.

Overall, the Recreation Alternative would result in beneficial aesthetic impacts to adjacent lands with the conversion of approximately 80 percent of the base to public facilities/recreation use; the land would be used in its natural state.

Mitigation Measures. No substantial adverse environmental impacts are anticipated under this alternative; therefore, no mitigation measures are required.

4.2.2.5 No-Action Alternative. The No-Action Alternative would not cause any physical changes in on-base land use from conditions at closure.

Aesthetics. The visual and aesthetic quality of base property and the surrounding areas would be enhanced under the No-Action Alternative, since landscaped areas would receive less intensive maintenance and would be allowed to revert to a more natural condition.

4.2.2.6 Other Land Use Concepts. Impacts of the proposed independent land use concepts are evaluated for compatibility with land use plans and regulations, impacts to on- and off-base land uses, and general land use trends in the region.

Michigan Army National Guard. This land use concept would be compatible with the Proposed Action and alternatives. Under the Proposed Action this concept would remove the northern alert apron and Building 608 from civilian aviation support and industrial uses, respectively. With the International Wayport Alternative, this concept would take the alert area and Building 608 out of civilian aviation support uses, and approximately 100 acres out of proposed timber production. Under the Commercial Aviation Alternative, the military use of Building 608 would be within an institutional (educational) land use. In addition, military use of the alert area would replace civilian industrial development, and approximately 100 acres would be taken out of proposed timber production. This concept would be compatible with the Recreation Alternative, with military use of the alert area and Building 608 replacing proposed industrial development.

Correctional Institution. This concept would be compatible with the Proposed Action and all alternatives. The correctional institution would replace 273 acres of proposed industrial and military development under the Proposed Action, and the same acreage of timber production under the International Wayport and Commercial Aviation alternatives. Under the Recreation Alternative, this concept would replace 273 acres of recreation land use.

Sawmill. The sawmill would be compatible with the Proposed Action and alternatives. The sawmill would replace 121 acres of industrial, 12 acres of aviation support, and 9 acres of public facilities/recreation land uses under the Proposed Action. It would replace 110 acres of industrial, 20 acres of aviation support, and 12 acres of public facilities/recreation land uses under the International Wayport Alternative; and replace 102 acres of industrial, 20 acres of aviation support, and 20 acres of public facilities/recreation land uses under the Commercial Aviation Alternative. Under the Recreation Alternative, 122 acres of public facilities/recreation land uses and 20 acres of industrial land uses would be replaced.

Waste to Energy/Recycling. This land use concept would be consistent and compatible with the industrial use of the heating plant area under the Proposed Action and alternatives. The waste to energy/recycling operation would replace 15 acres of industrial land uses under the Proposed Action. It would replace 1 acre of aviation support and 14 acres of industrial land uses under the International Wayport Alternative; 14 acres of industrial and 1 acre of agricultural land uses under the Commercial Aviation Alternative; and 14 acres of industrial and 1 acre of public facilities/recreation land uses under the Recreation Alternative.

Waste to Energy/Environmental Support Operations. This concept would generally be consistent and compatible with surrounding proposed uses under the Proposed Action and alternatives. The heating plant area is proposed for industrial use under the Proposed Action and alternatives. The industrial/administrative use of the service station, hobby shop, exchange store, and education center under this concept would be similar to their preclosure uses. Use of these buildings under this concept would replace 14 acres of industrial, 1 acre of commercial, and 3 acres of public/recreation land uses under the Proposed Action. It would replace 14 acres of industrial and 4 acres of commercial land uses under the International Wayport Alternative; and 14 acres of industrial, 2 acres of institutional, and 2 acres of commercial land uses under both the Commercial Aviation and Recreation alternatives.

4.2.3 Transportation

The effects of the alternatives on each component of the transportation system, including roadways, airspace and air traffic, and other modes of transportation, are presented in this section. Possible mitigation measures are discussed for those components likely to experience substantial adverse impacts under the alternatives.

Roadways. Reuse-related effects on roadway traffic were assessed by estimating the number of trips generated by each land use considering employees, visitors, residents, and service vehicles associated with construction and all other on-site activities for the Proposed Action and alternatives. Principal trip-generating land uses included industrial, commercial, residential, and airport uses.

The transportation analysis used the standard analysis techniques of trip generation, trip distribution, and traffic assignment. Trip generation was based on applying the trip rates from the Trip Generation Manual (Institute of Transportation Engineers, 1991b) to the existing and proposed land uses to determine total daily trips. Daily trips were distributed to and from the project site based on existing travel patterns for commuters and on the location of residences of base personnel. It was assumed that the residential choices of reuse-related employees would correspond to those of current base personnel.

Based on the results of the trip distribution analysis discussed above, trips were assigned to the surrounding roadway network along existing travel routes to the study area.

The increase in background traffic was obtained from the Marquette County Highway Department, and is based on projections of population and employment in the study area and surrounding region. This growth rate was assumed to be 1 percent per year.

Traffic effects were determined based on the LOS changes for each of the key roadways. Analyses were conducted for each reuse alternative and the No-Action Alternative. The latter alternative was included to identify the incremental impact of project-generated traffic over the traffic expected as a result of other growth in the Marquette region.

Airspace/Air Traffic. The airspace analysis examined the type and level of aircraft operations projected for the Proposed Action and International Wayport and Commercial Aviation alternatives, and compared them to the airspace configuration used under the preclosure reference. The impact analysis considered the relationship of the projected aircraft operations to the operational capacity of the airport, using criteria established by the FAA for determining airport service volumes. Potential effects on airspace use were assessed, based on the extent to which the Proposed Action and alternatives could (1) require modifications to the airspace structure or air traffic control systems and/or facilities; (2) restrict, limit, or otherwise delay other air traffic in the region; or (3) encroach on other airspace areas and uses.

The FAA is ultimately responsible for evaluating the specific effects that the reuse of an airport would have on the safe and efficient use of navigable airspace by aircraft. Such a study is based on details from the airport proponent's Airport Plan and consists of an airspace analysis, a flight safety review, and a review of the potential effect of the proposal on air traffic control and air navigation facilities. Once this study is completed, the FAA can determine the actual requirements for facilities, terminal and en route airspace, and instrument flight procedures.

Other Transportation Modes. Because none of the alternatives assume direct use of the local railroads, effects on the rail system are expected to be minimal.

4.2.3.1 Proposed Action

Roadways. Traffic generated on the roads within the ROI as a result of the Proposed Action land uses and direct employment is estimated to be 33,950 daily vehicle trips by 2015 (Table 4.2-1). This would represent an increase of 33,800 average daily trips over the No-Action Alternative for 2015. By 2015, approximately 70 percent of the total reuse-related trips would be generated by industrial uses. Other major land uses include aviation support, commercial, and residential.

Regional. By 2015, the traffic resulting from reuse would increase the afternoon PHV on U.S. 41 between SH 28 and SH 94 by 200 vehicles over the No-Action Alternative (Table 4.2-2). This increase would not degrade the operating conditions on this segment. Under the Proposed Action, the traffic generated by reuse on SH 35 from CR 553 to CR 456 through Gwinn

Table 4.2-1. Average Daily Trip Generation

	Year		
	2000	2005	2015
Proposed Action	8,900	17,250	33,950
International Wayport Alternative	14,350	20,250	30,400
Commercial Aviation Alternative	7,300	12,900	20,700
Recreation Alternative	2,600	4,450	6,200
No-Action Alternative	150	150	150

Note: All values are rounded to the nearest 50. Values represent average weekday trips.

would increase the PHV to 950 vehicles, representing an increase of 750 vehicles over the No-Action Alternative. This increase in traffic would degrade the operating conditions to LOS D, compared to LOS A under the No-Action Alternative. All other key regional road segments would continue to operate at LOS B or better.

Local. By 2015, traffic resulting from reuse would increase the afternoon PHV on the segments of CR 553 between CR 480 and Southgate Drive to approximately 2,050 vehicles, an increase of 1,550 over the No-Action Alternative. This increase would degrade the operating conditions on these segments of CR 553 to LOS F by 2015, compared to LOS C under the No-Action Alternative. The section of CR 553 from Southgate Drive to SH 35 would degrade to LOS D by 2015, compared to LOS B under the No-Action Alternative. CR 553 from the Marquette city limits to CR 480 would degrade to LOS E by 2015, compared to LOS C under the No-Action Alternative.

The afternoon PHV generated as a result of reuse on CR 480, west of CR 553, would increase by approximately 350 vehicles over the No-Action Alternative. This increase would degrade the operating conditions on this segment of CR 480 to LOS D by 2015, compared to LOS B under the No-Action Alternative.

By 2015, the traffic volume on CR 462, the main entrance to the base from CR 553 on the west, would show a significant increase under the Proposed Action. The afternoon PHV would increase by 1,760 vehicles, and the operating conditions would degrade to LOS E. Under the Proposed Action, CR 460 from Gate 2 (east base entrance) to CR 545 would operate at LOS D by 2015, compared to LOS A under the No-Action Alternative. The proposed access points from CR 553 to the new air carrier terminal and industrial areas on the west side of the base would operate at LOS C or better.

Table 4.2-2. Peak-Hour Traffic Volumes and LOS on Key Roads - Proposed Action

Roadway	Segment	Capacity	1995 PHV	1995 LOS	2000 PHV	2000 LOS	2005 PHV	2005 LOS	2015 PHV	2015 LOS
Local										
CR 462	Main Gate to CR 553	2,050	40	A	500	C	950	D	1,800	E
CR 460	Gate 2 to CR 545	2,050	10	A	300	B	550	C	1,100	D
CR 460	CR 545 to U.S. 41	2,050	150	A	250	B	350	B	600	C
CR 480	West of CR 553	1,750	350	B	450	C	550	C	750	D
CR 480	CR 553 to U.S. 41	2,050	300	B	350	B	400	B	450	B
CR 553	Marquette city limits to CR 480	2,050	450	B	700	C	900	D	1,300	E
CR 553	CR 480 to CR 462	2,050	400	B	850	D	1,250	E	2,050	F
CR 553	CR 462 to Southgate Drive	2,050	400	B	850	D	1,300	E	2,050	F
CR 553	Southgate Drive to SH 35	2,050	300	B	500	C	650	C	950	D
CR 545	U.S. 41 to CR 460	1,700	100	A	200	B	300	B	450	C
CR 545	CR 460 to CR 456	1,700	50	A	100	A	150	A	300	B
CR 456	SH 35 to CR 545	1,700	150	A	250	B	350	C	500	C
CR 456	CR 545 to U.S. 41	1,700	50	A	150	A	200	B	350	B
Regional										
U.S. 41	SH 28 to Skandia	2,050	700	C	800	C	900	D	1,050	D
U.S. 41	Skandia to SH 94	2,050	450	B	550	C	600	C	750	C
U.S. 41	SH 94 to CR 456	2,050	250	B	250	B	300	B	350	B
SH 35	CR 553 to CR 456	2,050	150	A	350	B	550	C	950	D
SH 35	CR 456 to Morbit Lake Access	2,050	100	A	100	A	150	A	150	A
New Access										
	CR 553 to Industrial Northwest	2,050	0	NA	200	A	350	B	650	C
	CR 553 to Industrial West	2,050	0	NA	200	A	350	B	650	C
	CR 553 to Air Carrier Terminal	2,050	0	NA	50	A	100	A	150	A

CR = County Road
LOS = Level of Service
NA = not applicable
PHV = peak-hour volume
SH = State Highway
U.S. # = U.S. Highway

With or without reuse, all other key local road segments would operate at LOS C or better throughout the period of analysis.

On-Base. As part of the eventual site development plan, internal circulation must accommodate reuse-related vehicular and pedestrian activities, and provide an acceptable LOS and adequate access from the local road network. Redevelopment plans are expected to incorporate internal circulation requirements that meet local planning objectives and standards.

Airspace/Air Traffic. The Proposed Action would include air cargo, aircraft maintenance, regional commercial, and general aviation activities. Under this alternative Marquette County Airport would be closed and relocated to K. I. Sawyer AFB.

Under the Proposed Action, the existing airport radar facility would remain in operation, ROI airspace management would be maintained, and expanded instrument approach services would be offered over those provided by Marquette County Airport. The military ILS would be replaced with a Category III ILS and PAPIs would be installed. The ATC tower would remain in use and the existing VOR approach to Runway 19 would be retained under the Proposed Action. Traffic levels in the airspace ROI would not be high enough to warrant an FAA-operated ATC tower, necessitating a privately operated facility.

Aircraft activity at the airport would be less than the preclosure level of 87,235 by 2015, when aircraft operations would reach 65,088. As the ROI represents a relatively unconstrained airspace area, the operations expected for the Proposed Action would have no adverse impact to airspace use. The single existing 12,300-foot runway (01/19) is capable of accommodating approximately 200,000 annual operations under FAA airport design guidelines. With 65,088 aircraft operations by 2015, approximately 32 percent of total airfield capacity would be utilized.

Air Transportation. Implementation of the Proposed Action would result in a new industrial and economic base in the region, which, in turn, would spur new growth in air travel demand. The use of K. I. Sawyer AFB as a regional airport could have a minor effect on travelers residing in the southernmost and northwesternmost parts of the ROI. The location of K. I. Sawyer AFB with respect to competing facilities may draw passengers from the southern edge of the ROI who currently use Delta County Airport (Escanaba) or Iron Mountain Airport. Conversely, residents in the northwest edge of the ROI, especially those in Baraga County who currently use Marquette County Airport, could find Hancock/Houghton Regional Airport more convenient. Because this effect is based on driving distance and the facilities in the ROI provide similar air service, the associated impacts would offset each other, and K. I. Sawyer AFB would not experience any measurable gain or loss in enplanements. The use of K. I. Sawyer AFB instead of Marquette County

Airport would not affect general aviation operations in the ROI because the proposed airport is capable of accommodating all types of general aviation aircraft. Because there is no air cargo service currently at Marquette County Airport, the proposed air cargo would provide this service to the ROI under the Proposed Action.

Mitigation Measures. By 2015, the traffic resulting from reuse would most affect the intersection of CR 462 and CR 553, which provides access to the Main Gate. Segments of CR 553 from CR 480 to Southgate Drive would operate at LOS F. Various mitigation measures could be implemented to bring these segments to an acceptable LOS by 2015. Actual mitigation measures would be developed by the Marquette County Road Commission. The mitigation selected by this agency would consider location, effectiveness, and cost of the improvements required to meet regional LOS recommendations. These road improvements could include geometric improvements or signalization at the intersection of CR 553 and CR 480 and the addition of grade separation for the intersection of CR 553 and CR 462. The implementation of these measures to improve LOS would only require minor modification to the local road network and would not be expected to have adverse effects on the environment. Other measures that could be implemented by the property recipient to reduce traffic on the road network include carpool and vanpool programs or flexible work schedules which would allow employees to travel to work during less congested hours. The implementation of such programs at a site can be very effective, reducing vehicle trips during the peak periods by as much as 30 to 40 percent in relation to background conditions (Institute of Transportation Engineers, 1993). It is recommended that growth and traffic volumes be carefully monitored by the regional transportation agencies to determine the appropriate timing and location of each improvement.

4.2.3.2 International Wayport Alternative

Roadways. Traffic generated on the roads within the ROI as a result of the International Wayport Alternative land uses and direct employment is estimated to be 30,400 daily vehicle trips by 2015 (see Table 4.2-1). This would represent an increase of 30,250 average daily trips over the No-Action Alternative for 2015. By 2015, approximately 86 percent of the total reuse-related trips would be generated by aviation support, industrial, commercial, and residential uses. Other land uses include institutional, public facilities/recreation, and agricultural (forest).

<u>Regional</u>. By 2015, the traffic resulting from reuse would increase the afternoon PHV on U.S. 41 between SH 28 and SH 94 by 150 vehicles over the No-Action Alternative (Table 4.2-3). This increase would not degrade the operating conditions on this segment. Under the International Wayport Alternative, the traffic generated by reuse on SH 35 from CR 553 to CR 456 through Gwinn would increase the PHV to 750 vehicles, representing an

Table 4.2-3. Peak-Hour Traffic Volumes and LOS on Key Roads - International Wayport Alternative

Roadway	Segment	Capacity	1995 PHV	1995 LOS	2000 PHV	2000 LOS	2005 PHV	2005 LOS	2015 PHV	2015 LOS
Local										
CR 462	Main Gate to CR 553	2,050	40	A	950	D	1,350	E	2,050	F
CR 460	Gate 2 to CR 545	2,050	10	A	400	B	500	C	800	C
CR 460	CR 545 to U.S. 41	2,050	150	A	300	B	400	B	500	C
CR 480	West of CR 553	1,750	350	B	450	C	550	C	650	C
CR 480	CR 553 to U.S. 41	2,050	300	B	350	B	400	B	450	B
CR 553	Marquette city limits to CR 480	2,050	450	B	750	C	900	D	1,150	D
CR 553	CR 480 to CR 462	2,050	400	B	950	D	1,200	E	1,700	E
CR 553	CR 462 to Southgate Drive	2,050	400	B	1,000	D	1,250	E	1,700	E
CR 553	Southgate Drive to SH 35	2,050	300	B	500	C	650	C	800	C
CR 545	U.S. 41 to CR 460	1,700	100	A	200	B	300	B	400	C
CR 545	CR 460 to CR 456	1,700	50	A	100	A	150	A	250	B
CR 456	SH 35 to CR 545	1,700	150	A	250	B	300	B	400	C
CR 456	CR 545 to U.S. 41	1,700	50	A	150	A	200	B	300	B
Regional										
U.S. 41	SH 28 to Skandia	2,050	700	C	800	C	900	D	1,000	D
U.S. 41	Skandia to SH 94	2,050	450	B	550	C	600	C	700	C
U.S. 41	SH 94 to CR 456	2,050	250	B	300	B	300	B	350	B
SH 35	CR 553 to CR 456	2,050	150	A	400	B	550	C	750	C
SH 35	CR 456 to Morbit Lake Access	2,050	100	A	100	A	150	A	150	A
New Access										
	CR 553 to Base	2,050	0	NA	200	A	250	B	400	B

CR = County Road
LOS = Level of Service
NA = not applicable
PHV = peak-hour volume
SH = State Highway
U.S. # = U.S. Highway

increase of 550 vehicles over the No-Action Alternative. This increase in traffic would degrade the operating conditions to LOS C, compared to LOS A under the No-Action Alternative. All other key regional road segments would continue to operate at LOS B or better.

Local. By 2015, traffic resulting from reuse would increase the afternoon peak hour traffic on the segments of CR 553 between CR 480 and Southgate Drive to approximately 1,700 vehicles, an increase of 1,200 over the No-Action Alternative. This increase would degrade the operating conditions on these segments of CR 553 to LOS E by 2015, compared to LOS C under the No-Action Alternative. The section of CR 553 from Southgate Drive to SH 35 will degrade to LOS C, compared to LOS B under the No-Action Alternative. The LOS on CR 553 from the Marquette city limits to CR 480 would degrade to LOS D by 2015, compared to LOS C under the No-Action Alternative.

The afternoon PHV generated as a result of reuse on CR 480, west of CR 553, would increase by approximately 250 vehicles over the No-Action Alternative. This increase would degrade the operating conditions on this segment of CR 480 to LOS C by 2015, compared to LOS B under the No-Action Alternative.

By 2015, the traffic volume on CR 462, the main entrance to the base from CR 553 on the west, would show a significant increase under the International Wayport Alternative. The afternoon PHV would increase by 2,010 vehicles, and the operating conditions would degrade to LOS F. The proposed access point from CR 553 to the proposed new air carrier terminal would operate at LOS B with a PHV of 400 vehicles.

With or without reuse, all other key local road segments would operate at LOS C or better throughout the period of analysis.

On-Base. As part of the eventual site development plan, internal circulation must accommodate reuse-related vehicular and pedestrian activities, and provide an acceptable LOS and adequate access from the local road network. Redevelopment plans are expected to incorporate internal circulation requirements that meet local planning objectives and standards.

Airspace/Air Traffic. The International Wayport Alternative includes international passenger, air cargo, aircraft maintenance, regional commercial, and general aviation activities. Under this alternative, Marquette County Airport would be closed and relocated to K. I. Sawyer AFB.

Under the International Wayport Alternative, the existing airport radar facility would continue operation, ROI airspace management would be maintained, and expanded instrument approach services would be offered over those provided by Marquette County Airport. The military ILS would be replaced with a Category III ILS and PAPIs would be installed. The existing VOR approach to Runway 19 would be retained for use. The ATC tower would remain in use under this alternative. Traffic levels in the airspace ROI would be high enough to warrant an FAA-operated ATC tower by 2005. It is

possible that the FAA would decline to operate the ATC tower earlier in the planning period, necessitating a privately operated facility in the interim.

Aircraft operations at the new international wayport would exceed the preclosure level of 87,235 by 2015, when aircraft operations would reach 100,000. As the ROI represents a relatively unconstrained airspace area, the change in operations because of this alternative would have no adverse impact. The single existing 12,300-foot runway (01/19) and the proposed general aviation crosswind runway (12/30) are capable of accommodating approximately 300,000 annual operations under FAA airport design guidelines. With 100,000 aircraft operations by 2015, approximately 33 percent of total airfield capacity would be utilized.

Air Transportation. Implementation of the International Wayport Alternative would result in a new industrial and economic base in the region, which, in turn, would spur new growth in air travel demand. With the closure of Marquette County Airport and the relocation of aircraft activity to K. I. Sawyer AFB, no changes in regional air transportation for the ROI are expected in the short term. Because of K. I. Sawyer AFB's location relative to other airports in the Upper Peninsula, it is anticipated that K. I. Sawyer AFB would continue to draw traffic from the same population base as Marquette County Airport. However, increased use of the airport under the international wayport concept could provide for more direct flights to domestic non-stop destinations, which may, in turn, draw passengers from other regional airports such as Escanaba or Iron Mountain. The facilities at the new airport proposed under this alternative would be able to accommodate this increased demand in commercial service and would provide international air cargo service to the ROI. The Marquette County Airport does not currently provide air cargo service. The use of K. I. Sawyer AFB instead of Marquette County Airport would not affect general aviation operations in the region because the proposed airport is capable of accommodating all types of general aviation aircraft.

Mitigation Measures. By 2015, the traffic resulting from reuse would degrade the operating condition of the intersection of CR 462 and CR 553 (main base access) to LOS F. Various mitigation measures as described for the Proposed Action could be implemented to bring these segments to an acceptable LOS by 2015.

4.2.3.3 Commercial Aviation Alternative

Roadways. Traffic generated on the roads within the ROI as a result of the Commercial Aviation Alternative land uses and direct employment is estimated to be 20,700 average daily vehicle trips by 2015 (see Table 4.2-1). This would represent an increase of 20,550 average daily trips over the No-Action Alternative for 2015. By 2015, approximately 67 percent of the total reuse-related trips would be generated by

institutional (educational) and aviation reuses. Other land uses include commercial, industrial, public facilities/recreation, and agricultural (forest).

Regional. By 2015, traffic resulting from reuse would increase the afternoon PHV on U.S. 41 between SH 28 and SH 94 by 100 vehicles over the No-Action Alternative (Table 4.2-4). This increase would not degrade the operating conditions on this segment. PHV on SH 35 between CR 553 and CR 456 would increase by 350 vehicles over the No-Action Alternative because of reuse activities. This increase would degrade operating conditions to LOS C by 2015, compared to LOS A under the No-Action Alternative. All other key regional road segments would continue to operate at LOS B or better.

Local. Afternoon PHV generated by reuse on CR 462 (the main base access) would increase the PHV volumes in 2015 by 1,660 over the No-Action Alternative. This traffic would degrade operating conditions to LOS E, compared to LOS A under the No-Action Alternative. Reuse-related traffic on CR 480 west of CR 553 would increase the PHV by 200 vehicles, resulting in LOS C by 2015, compared to LOS B under the No-Action Alternative.

Under the Commercial Aviation Alternative, traffic generated by reuse would increase the afternoon PHV in 2015 by up to 800 vehicles on CR 553 between the Marquette city limits and Southgate Drive. This increase would degrade the operating conditions on the CR 480 to Southgate Drive segment of CR 553 to LOS E by 2015, compared to LOS C under the No-Action Alternative. The Marquette city limits to CR 480 segment of CR 553 would operate at LOS D by 2015, compared to LOS C under the No-Action Alternative. With or without reuse, all other key local road segments would operate at LOS C or better throughout the period of analysis.

On-Base. As part of the eventual site development plan, internal circulation must accommodate reuse-related vehicular and pedestrian activities and provide an acceptable LOS and adequate access from the local road network. Redevelopment plans are expected to incorporate internal circulation requirements that meet local planning objectives and standards.

Airspace/Air Traffic. The Commercial Aviation Alternative includes regional commercial and general aviation operations. Under this alternative, Marquette County Airport would be closed and relocated to K. I. Sawyer AFB.

Under the Commercial Aviation Alternative, the existing radar facility at K. I. Sawyer AFB would be retained and the ATC tower would remain in use. Traffic levels in the airspace ROI would not be high enough to warrant an FAA-operated ATC tower, which may necessitate a privately operated facility. The military ILS would be replaced by a Category I ILS, and PAPIs

Table 4.2-4. **Peak-Hour Traffic Volumes and LOS on Key Roads - Commercial Aviation Alternative**

			1995		2000		2005		2015	
Roadway	Segment	Capacity	PHV	LOS	PHV	LOS	PHV	LOS	PHV	LOS
Local										
CR 462	Main Gate to CR 553	2,050	40	A	600	C	1,050	D	1,700	E
CR 460	Gate 2 to CR 545	2,050	10	A	200	A	350	B	550	C
CR 460	CR 545 to U.S. 41	2,050	150	A	250	B	300	B	400	B
CR 480	West of CR 553	1,750	350	B	400	B	500	C	600	C
CR 480	CR 553 to U.S. 41	2,050	300	B	350	B	350	B	400	B
CR 553	Marquette city limits to CR 480	2,050	450	B	600	C	750	C	950	D
CR 553	CR 480 to CR 462	2,050	400	B	700	C	950	D	1,300	E
CR 553	CR 462 to Southgate Drive	2,050	400	B	700	C	950	D	1,300	E
CR 553	Southgate Drive to SH 35	2,050	300	B	400	B	500	C	650	C
CR 545	U.S. 41 to CR 460	1,700	100	A	150	A	200	B	300	B
CR 545	CR 460 to CR 456	1,700	50	A	50	A	100	A	150	A
CR 456	SH 35 to CR 545	1,700	150	A	200	B	250	B	350	B
CR 456	CR 545 to U.S. 41	1,700	50	A	100	A	150	A	200	B
Regional										
U.S. 41	SH 28 to Skandia	2,050	700	C	750	C	850	D	950	D
U.S. 41	Skandia to SH 94	2,050	450	B	500	C	550	C	650	C
U.S. 41	SH 94 to CR 456	2,050	250	B	250	B	300	B	350	B
SH 35	CR 553 to CR 456	2,050	150	A	300	B	400	B	550	C
SH 35	CR 456 to Morbit Lake Access	2,050	100	A	100	A	100	A	150	A

CR = County Road
LOS = Level of Service
PHV = peak-hour volume
SH = State Highway
U.S. # = U.S. Highway

would be installed. The existing VOR approach to Runway 19 would be retained for use.

Aircraft operations at the airport by 2015 would be 60,900, less than the preclosure level of 87,235. As the ROI represents a relatively unconstrained airspace area, the operations proposed for the Commercial Aviation Alternative would have no adverse impact to airspace use. The single proposed 6,500-foot runway (01/19) would be capable of accommodating approximately 200,000 annual operations under FAA airport design

guidelines. With 60,900 aircraft operations by 2015, approximately 30 percent of the total airfield capacity would be utilized.

Air Transportation. The Commercial Aviation Alternative assumes the closure of Marquette County Airport and the transfer of operations to K. I. Sawyer AFB. Impacts to air transportation would be the same as those discussed for the Proposed Action, except no air cargo service would be provided under the Commercial Aviation Alternative.

Mitigation Measures. As no highway segment would degrade to LOS F within the analysis period, no mitigation would be required for area roadways.

4.2.3.4 Recreation Alternative

Roadways. Traffic generated on the roads within the ROI as a result of the Recreation Alternative land uses and direct employment is estimated to be 6,200 daily vehicle trips by 2015 (see Table 4.2-1). This would represent an increase of 6,050 average daily trips over the No-Action Alternative for 2015. By 2015, approximately 69 percent of the total reuse-related trips would be generated by residential and public facilities/recreation reuses. Other land uses include industrial, institutional (educational), and commercial.

Regional. By 2015, traffic resulting from reuse would not affect the afternoon PHV on U.S. 41 between SH 28 and SH 94 (Table 4.2-5). LOS D for the segment between SH 28 and Skandia and LOS C between Skandia and SH 94 would occur with or without reuse-related activities. All other key regional road segments would continue to operate at LOS B or better.

Local. Reuse-related traffic on CR 480 west of CR 553 would increase the PHV by 50 vehicles. This increase would degrade the operating conditions to LOS C by 2015, compared to LOS B under the No-Action Alternative.

Under the Recreation Alternative, traffic generated by reuse would increase the afternoon PHV in 2015 by up to 200 vehicles on CR 553 between the Marquette city limits and Southgate Drive. Under the Recreation Alternative, the Marquette city limits to CR 480 segment of CR 553 would operate at LOS C with or without reuse.

With or without reuse, all other key local road segments would operate at LOS B or better throughout the period of analysis.

On-Base. As part of the eventual site development plan, internal circulation must accommodate reuse-related vehicular and pedestrian activities and provide an acceptable LOS and adequate access from the local road

Table 4.2-5. Peak-Hour Traffic Volumes and LOS on Key Roads - Recreation Alternative

Roadway	Segment	Capacity	1995		2000		2005		2015	
			PHV	LOS	PHV	LOS	PHV	LOS	PHV	LOS
Local										
CR 462	Main Gate to CR 553	2,050	40	A	200	A	300	B	450	B
CR 460	Gate 2 to CR 545	2,050	10	A	50	A	100	A	150	A
CR 460	CR 545 to U.S. 41	2,050	150	A	200	B	200	A	250	B
CR 480	West of CR 553	1,750	350	B	400	C	400	C	450	C
CR 480	CR 553 to U.S. 41	2,050	300	B	300	B	350	B	400	B
CR 553	Marquette city limits to CR 480	2,050	450	B	500	C	550	C	650	C
CR 553	CR 480 to CR 462	2,050	400	B	500	C	550	D	700	C
CR 553	CR 462 to Southgate Drive	2,050	400	B	500	C	550	D	700	C
CR 553	Southgate Drive to SH 35	2,050	300	B	350	B	400	B	450	B
CR 545	U.S. 41 to CR 460	1,700	100	A	100	A	150	A	150	A
CR 545	CR 460 to CR 456	1,700	50	A	50	A	50	A	50	A
CR 456	SH 35 to CR 545	1,700	150	A	150	A	200	B	200	B
CR 456	CR 545 to U.S. 41	1,700	50	A	50	A	100	A	100	A
Regional										
U.S. 41	SH 28 to Skandia	2,050	700	C	750	C	800	C	900	D
U.S. 41	Skandia to SH 94	2,050	450	B	500	C	500	C	550	C
U.S. 41	SH 94 to CR 456	2,050	250	B	250	B	300	B	300	B
SH 35	CR 553 to CR 456	2,050	150	A	200	A	200	A	250	B
SH 35	CR 456 to Morbit Lake Access	2,050	100	A	100	A	100	A	150	A

CR = County Road
LOS = Level of Service
PHV = peak-hour volume
SH = State Highway
U.S. # = U.S. Highway

network. Redevelopment plans are expected to incorporate internal circulation requirements that meet local planning objectives and standards.

Airspace/Air Traffic. This alternative does not include any aviation reuse at K. I. Sawyer AFB. As a result, ail existing navigational aids, airspace, and air traffic services associated with the base would be discontinued. Operations at Marquette County Airport would continue. Although IFR radar coverage would be lost due to the possible decommissioning of the RAPCON, no impacts are anticipated due to the low volume of aircraft

movements in the ROI. No airspace or air traffic impacts would result from closure of the base.

Air Transportation. There would be no impact to the region's air transportation under the Recreation Alternative.

Mitigation Measures. As no highway segment would degrade to LOS F within the analysis period, no mitigation would be required for area roadways.

4.2.3.5 No-Action Alternative

Roadways. This alternative would result in the base being placed in caretaker status. Traffic generated on the roads within the ROI as a result of the No-Action Alternative is estimated to be 150 daily vehicle trips by 2015 (see Table 4.2-1), and access to the base would be limited to the Main Gate.

Under the No-Action Alternative, the expected population growth and development unrelated to reuse of K. I. Sawyer AFB would lead to traffic volume increases on local roadways through 2015. It is projected that non-reuse-related traffic volumes on key roads would increase by 1 percent annually during the period of analysis. The traffic volumes generated by the OL are assumed to remain the same over the 20-year analysis period.

Table 4.2-6 presents the projected baseline PHV on key roads and the associated LOS that would result under the No-Action Alternative. Under the No-Action Alternative, afternoon PHV by 2015 is projected to be 550 on CR 553 near the Marquette city limits, and 350 near Southgate Drive (Table 4.2-6). These volumes would bring operating conditions to LOS C by 2015. Afternoon PHV by 2015 is projected to be 850 on U.S. 41 between SH 28 and Skandia, and 550 between Skandia and SH 94. These volumes would bring operating conditions on U.S. 41 to LOS D and LOS C, respectively. All other key road segments would operate at LOS B or better.

In the absence of any civilian reuse of the base, traffic volume on base roads would be similar to closure conditions.

Airspace/Air Traffic. Cessation of all air operations at K. I. Sawyer AFB and the possible decommissioning of the navigational equipment would have the same effects on airspace in the ROI as discussed for the Recreation Alternative.

Air Transportation. There would be no impact to the region's air transportation under the No-Action Alternative.

Table 4.2-6. Peak-Hour Traffic Volumes and LOS on Key Roads - No-Action Alternative

Roadway	Segment	Capacity	1995 PHV	1995 LOS	2000 PHV	2000 LOS	2005 PHV	2005 LOS	2015 PHV	2015 LOS
Local										
CR 462	Main Gate to CR 553	2,050	40	A	40	A	40	A	40	A
CR 460	Gate 2 to CR 545	2,050	10	A	10	A	10	A	10	A
CR 460	CR 545 to U.S. 41	2,050	150	A	150	A	150	A	200	A
CR 480	West of CR 553	1,750	350	B	350	B	400	B	400	B
CR 480	CR 553 to U.S. 41	2,050	300	B	300	B	350	B	350	B
CR 553	Marquette city limits to CR 480	2,050	450	B	450	B	500	C	550	C
CR 553	CR 480 to CR 462	2,050	400	B	400	B	450	B	500	C
CR 553	CR 462 to Southgate Drive	2,050	400	B	400	B	450	B	500	C
CR 553	Southgate Drive to SH 35	2,050	300	B	300	B	350	B	350	B
CR 545	U.S. 41 to CR 460	1,700	100	A	100	A	100	A	100	A
CR 545	CR 460 to CR 456	1,700	50	A	50	A	50	A	50	A
CR 456	SH 35 to CR 545	1,700	150	A	150	A	150	A	200	B
CR 456	CR 545 to U.S. 41	1,700	50	A	50	A	50	A	50	A
Regional										
U.S. 41	SH 28 to Skandia	2,050	700	C	750	C	750	C	850	D
U.S. 41	Skandia to SH 94	2,050	450	B	450	B	500	C	550	C
U.S. 41	SH 94 to CR 456	2,050	250	B	250	B	300	B	300	B
SH 35	CR 553 to CR 456	2,050	150	A	150	A	150	A	200	A
SH 35	CR 456 to Morbit Lake Access	2,050	100	A	100	A	100	A	100	A

CR = County Road
LOS = Level of Service
PHV = peak-hour volume
SH = State Highway
U.S. # = U.S. Highway

4.2.3.6 Other Land Use Concepts. Transportation effects are discussed for each independent land use concept. The analysis considers the impact of the implementation of each of these plans in conjunction with the alternatives. The proposals would not affect airspace, air transportation, or rail transportation.

Michigan Army National Guard. This proposal would generate approximately 150 weekend trips, representing a 2.0 percent or less increase in traffic. The MANG would not affect the projected LOS on key road segments under the Proposed Action and alternatives. Overall impacts and mitigations in conjunction with this concept would be similar to those described under the Proposed Action and alternatives.

Correctional Institution. The major traffic generators for this land use concept would be the 250 full-time employees, plus visitors and service vehicles at the site. The correctional institution would generate approximately 50 vehicles per hour during the afternoon peak hour, resulting in a net reduction of 315 vehicles per hour under the Proposed Action. The reduction in trips may improve the LOS on both regional and local roads. Under the International Wayport and Commercial Aviation alternatives, the additional traffic from this land use concept could exacerbate conditions on local roads, some of which are projected to operate at LOS E and LOS F during peak hours by 2015. For road segments that would operate at LOS F in conjunction with this concept appropriate mitigation measures would be similar to those described under the Proposed Action and alternatives. Little or no effect to LOS on nearby key road segments is projected for this land use concept in combination with the Recreation Alternative.

Sawmill. The traffic generated from this land use concept would be from the 90 full-time employees and from truck transportation of lumber. The sawmill would generate approximately 60 vehicles per hour during the afternoon peak hour, resulting in a net reduction in traffic under the Proposed Action and International Wayport Alternative. The reduction in trips would have little effect on the LOS on both regional and local roads. There would be no net change in the traffic generated from implementation of this concept under the Commercial Aviation Alternative. Little or no effect to LOS on nearby key road segments is projected for this land use concept in combination with the Recreation Alternative. For road segments that would operate at LOS F in conjunction with this concept, appropriate mitigation measures would be similar to those described under the Proposed Action and alternatives. Use of the existing rail line next to K. I. Sawyer AFB would result in a negligible increase in train use.

Waste to Energy/Recycling. The traffic generated from this land use concept would be from the 50 full-time employees, visitors/trainees, and the transportation of municipal solid waste by truck. The waste to energy/ recycling would generate approximately 50 vehicles per hour during the afternoon peak hour, resulting in a net reduction in traffic conditions presented for the Proposed Action and alternatives. The reduction in trips would have little effect on the LOS on both regional and local roads. Rail use associated with this concept would not affect regional rail transportation.

Waste to Energy/Environmental Support Operations. The traffic generated from this land use concept would be from the 100 full-time employees and from the transportation of municipal solid waste and other wastes by truck. The waste to energy/environmental support operations proposal would generate approximately 70 vehicles per hour during the afternoon peak hour, resulting in a net reduction in the traffic conditions presented for the Proposed Action and alternatives. The reduction in trips would have little

effect on the LOS on both regional and local roads. Rail use associated with this concept would not affect regional rail transportation.

4.2.4 Utilities

Direct and indirect changes in future utility use for the Proposed Action and alternatives were estimated based on historic, preclosure, and per capita average daily use on K. I. Sawyer AFB and in the ROI. These factors were applied to projections of numbers of future residents and employees associated with the Proposed Action and alternatives. Table 4.2-7 shows the projected changes in utility demand for 5, 10, and 20 years after closure. The figures shown for the No-Action Alternative generally reflect the changes expected in utility use in the area without redevelopment of the base. The Proposed Action and alternatives reflect growth anticipated with base reuse.

4.2.4.1 Proposed Action. Table 4.2-7 presents a summary of ROI utility demands and percentage increases associated with this alternative.

Water Consumption. The total average daily water demand in the ROI by 2015 is expected to be 6.89 MGD, which includes a reuse-related average daily water demand of 3.79 MGD. With the capacity to treat a total of 11.3 MGD of water, the communities in the ROI would have adequate capacity to meet the demands associated with this alternative.

Reuse-related average daily water demand on the base would total 2.4 MGD, an increase of 2.38 MGD from the 0.02 MGD at closure. Approximately 2.06 MGD, or 86 percent, are expected to be used by industrial reuses. Other reuse-related water demand includes residential and commercial. The base water system has the capability to process approximately 3.0 MGD. Reuse of the on-base water system may require certain improvements depending on the type and location of development that occurs. Once specific development proposals are identified, improvements can be designed.

Wastewater. The Proposed Action would increase the total projected wastewater flow in the ROI over the No-Action Alternative projections by 1.88 MGD, or 50.95 percent, to 5.57 MGD by 2015. The ROI has a wastewater treatment capacity of 8.4 MGD.

Wastewater flows on base would increase from 0.01 MGD in 1995 to 0.8 MGD by 2015. The base WWTP has the capability to process up to 2.5 MGD. Approximately 0.69 MGD, or 86 percent, is expected to be produced by industrial and residential reuses. Prior to base reuse the WWTP may require modification to process the reduced wastewater flows, which would be less than under preclosure conditions. New users would be required to obtain discharge permits from the operators of the existing

Table 4.2-7. Projected Reuse-Related Average Daily Utility Use in the ROI

	2000			2005			2015		
	Total ROI	Reuse-Related	Percent Increase	Total ROI	Reuse-Related	Percent Increase	Total ROI	Reuse-Related	Percent Increase
Water Consumption (MGD)									
No-Action Alternative[a]	2.84			2.93			3.10		
Proposed Action	3.80	0.96	33.80	4.81	1.88	64.16	6.89	3.79	122.25
International Wayport Alternative	3.56	0.72	25.35	3.93	1.00	34.13	4.58	1.48	47.77
Commercial Aviation Alternative	3.19	0.35	12.32	3.57	0.64	21.84	4.14	1.04	33.55
Recreation Alternative	2.94	0.10	3.52	3.10	0.17	5.80	3.37	0.27	8.71
Wastewater Treatment (MGD)									
No-Action Alternative[a]	3.39			3.49			3.69		
Proposed Action	3.86	0.47	13.86	4.41	0.92	26.36	5.57	1.88	50.95
International Wayport Alternative	3.99	0.60	17.70	4.33	0.84	24.07	4.93	1.24	33.60
Commercial Aviation Alternative	3.67	0.28	8.26	4.00	0.51	14.61	4.55	0.86	23.31
Recreation Alternative	3.46	0.07	2.06	3.62	0.13	3.72	3.90	0.21	5.69
Solid Waste Disposal (tons/day)									
No-Action Alternative[a]	164.60			169.20			179.70		
Proposed Action	176.16	11.56	7.02	191.24	22.04	13.03	223.78	44.08	24.53
International Wayport Alternative	178.70	14.10	8.57	189.14	19.94	11.78	209.67	29.97	16.68
Commercial Aviation Alternative	171.29	6.69	4.06	181.03	11.83	6.99	199.08	19.38	10.78
Recreation Alternative	166.45	1.85	1.12	172.66	3.46	2.04	185.41	5.71	3.18
Electrical Consumption (MWH/day)									
No-Action Alternative[a]	987.06			1,038.13			1,146.10		
Proposed Action	1,042.12	55.06	5.58	1,142.03	103.90	10.01	1,351.26	205.16	17.90
International Wayport Alternative	1,066.47	79.41	8.05	1,145.85	107.72	10.38	1,299.94	153.84	13.42
Commercial Aviation Alternative	1,023.10	36.04	3.65	1,102.64	64.51	6.21	1,251.71	105.61	9.21
Recreation Alternative	995.05	7.99	0.81	1,053.75	15.62	1.50	1,171.69	25.59	2.23
Natural Gas Consumption (MMCF/day)									
No-Action Alternative[a]	9.40			9.70			10.29		
Proposed Action	10.00	0.60	6.38	10.86	1.16	11.96	12.62	2.33	22.64
International Wayport Alternative	10.12	0.72	7.66	10.69	0.99	10.21	11.75	1.46	14.19
Commercial Aviation Alternative	9.79	0.39	4.15	10.38	0.68	7.01	11.37	1.08	10.50
Recreation Alternative	10.28	0.88	9.36	10.68	0.98	10.10	11.38	1.09	10.59

Note: (a) Represents total average daily use in the ROI for the year indicated based on projections by local utility purveyors.
MGD = million gallons per day
MMCF = million cubic feet
MWH = megawatt-hours
ROI = Region of Influence

WWTP. The WWTP operator would monitor effluent from the plant to ensure the NPDES permit requirements are met.

Solid Waste. With the Proposed Action, solid waste disposal rates in the ROI would increase to 223.78 tons per day by 2015, compared to 179.7 tons per day with the No-Action Alternative. The life span of the Marquette County Landfill would be reduced by 4 years from this 24.53 percent increase.

Reuse-related solid waste generated on base, included in the amount above, would be 21 tons per day in 2015 compared to 0.15 ton per day at closure. Approximately 16.59 tons per day, or 79 percent, would be generated by industrial and residential reuses.

Energy

Electricity. Reuse-related demands of 205.16 MWH per day would increase electrical consumption in the ROI to 1,351.26 MWH per day. This increase of 17.90 percent over the No-Action Alternative projections would be adequately met by electrical purveyors.

By 2015, this alternative would create an electrical demand on base of 151 MWH per day, compared to 15 MWH per day at closure. Approximately 99.66 MWH per day, or 66 percent, of the electrical demand would be created by industrial reuses. The existing substation and distribution system may require upgrades depending on the timing and specific location of the proposed reuses. Once specific proposals are identified, improvements can be negotiated with UPPCO. Individual facilities would need to be metered, and appropriate utility corridors and easements would need to be established.

Natural Gas. The average daily natural gas demand in the ROI by 2015 is expected to be 12.62 MMCF per day, which includes a reuse-related average daily demand of 2.33 MMCF per day. Natural gas demands in the ROI are forecast to be 10.29 MMCF per day by 2015 with the No-Action Alternative. This increase of 22.64 percent would be adequately met by the supplies of Michigan Gas Company and Michigan Consolidated Gas Company.

Reuse-related natural gas consumption on base would be 1.3 MMCF per day by 2015. Approximately 0.98 MMCF per day, or 75 percent, would be consumed by industrial and residential reuses. The existing on-base natural gas distribution would require some changes to accommodate the reuse of the base, including the installation of individual gas meters at most facilities. Appropriate utility corridors and easements would also have to be established.

Mitigation Measures. No substantial adverse environmental impacts are anticipated under the Proposed Action; therefore, no mitigation is required.

4.2.4.2 International Wayport Alternative. Table 4.2-7 presents a summary of ROI utility demands and percentage increases associated with this alternative.

Water Consumption. The total average daily water demand in the ROI by 2015 is expected to be 4.58 MGD, which includes a reuse-related average daily water demand of 1.48 MGD. With the capacity to treat a total of 11.3 MGD of water, the communities in the ROI would have adequate capacity to meet the demands associated with this alternative.

Reuse-related average daily water demand on the base would total 0.90 MGD. This is an increase of 0.88 MGD from the 0.02 MGD at closure. Approximately 0.76 MGD, or 85 percent, is expected to be used by institutional (educational) and residential reuses. Other reuse-related water demand includes the golf course. Reuse of the on-base water system may require certain improvements depending on the type and location of development that occurs. Once specific development proposals are identified, improvements can be designed.

Wastewater. This alternative would increase the total projected wastewater flow in the ROI over the No-Action Alternative projections by 1.24 MGD, or 33.60 percent, to 4.93 MGD by 2015. The ROI has a wastewater treatment capacity of 8.4 MGD.

Wastewater flows on base would increase from 0.01 MGD in 1995 to 0.80 MGD by 2015. The base WWTP has the capability to process up to 2.5 MGD. Approximately 0.696 MGD, or 87 percent, is expected to be produced by institutional (educational) and residential reuses. Effects to the WWTP because of reduced flows under this alternative would be similar to the Proposed Action.

Solid Waste. With the International Wayport Alternative, solid waste disposal rates in the ROI would increase to 209.67 tons per day by 2015, compared to 179.7 tons per day with the No-Action Alternative. The life span of the existing Marquette County Landfill would be only slightly affected with this 16.68 percent increase.

Reuse-related solid waste generated on base, included in the amount above, would be 21 tons per day in 2015 compared to 0.15 ton per day at closure. Approximately 14.28 tons per day, or 68 percent, would be generated by industrial and residential reuses.

Energy

Electricity. Reuse-related demands of 153.84 MWH per day would increase electrical consumption in the ROI to 1,299.94 MWH per day. This increase of 13.42 percent over the No-Action Alternative projections would be adequately met by electrical purveyors.

By 2015, this alternative would create an electrical demand on base of 133 MWH per day, compared to 15 MWH per day at closure. Approximately 71 percent of the electrical demand would be created by the industrial and residential reuses. Once specific proposals are identified, improvements can be negotiated with UPPCO. Individual facilities would need to be metered, and appropriate utility corridors and easements would need to be established.

Natural Gas. The average daily natural gas demand in the ROI by 2015 is expected to be 11.75 MMCF per day, which includes a reuse-related average daily demand of 1.46 MMCF per day. Natural gas demands in the ROI under the No-Action Alternative are forecast to be 10.29 MMCF per day by 2015. This increase of 14.19 percent over the No-Action Alternative would be adequately met by the supplies of Michigan Gas Company and Michigan Consolidated Gas Company.

Reuse-related natural gas consumption on base would be 1.1 MMCF per day by 2015. Approximately 0.682 MMCF per day, or 62 percent, would be consumed by industrial and residential reuses. The existing on-base natural gas distribution would require some changes to accommodate the reuse of the base, including the installation of individual gas meters at most facilities. Appropriate utility corridors and easements would also have to be established.

Mitigation Measures. No substantial adverse environmental impacts are anticipated under this alternative; therefore, no mitigation measures are required.

4.2.4.3 Commercial Aviation Alternative. Table 4.2-7 presents a summary of ROI utility demands and percentage increases associated with this alternative.

Water Consumption. The total average daily water demand in the ROI by 2015 is expected to be 4.14 MGD, which includes a reuse-related average daily water demand of 1.04 MGD. With the capacity to treat a total of 11.3 MGD of water, the communities in the ROI would have adequate capacity to meet the demands associated with this alternative.

Reuse-related average daily water demand on the base would total 0.7 MGD. This is an increase of 0.68 MGD from the 0.02 MGD at closure.

Approximately 0.52 MGD, or 74 percent, is expected to be used by institutional (educational) and residential reuses. Other reuse-related water demand includes the golf course. Reuse of the on-base water system may require certain improvements depending on the type and location of development that occurs. Once specific development proposals are identified, improvements can be designed.

Wastewater. This alternative would increase the total projected wastewater flow in the ROI over the No-Action Alternative projections by 0.86 MGD, or 23.31 percent, to 4.55 MGD by 2015. The ROI has a wastewater treatment capacity of 8.4 MGD.

Wastewater flows on base would increase from 0.01 MGD in 1995 to 0.6 MGD by 2015. The base WWTP has the capability to process up to 2.5 MGD. Approximately 0.46 MGD, or 77 percent, is expected to be produced by institutional (educational) and residential reuses. Effects to the WWTP because of reduced flows under this alternative would be similar to the Proposed Action.

Solid Waste. With the Commercial Aviation Alternative, solid waste disposal rates in the ROI would increase to 199.08 tons per day by 2015, compared to 179.7 tons per day with the No-Action Alternative. The life span of the existing Marquette County Landfill would be only slightly affected with this 10.78 percent increase.

Reuse-related solid waste generated on base, included in the amount above, would be 14 tons per day in 2015, compared to 0.15 ton per day at closure. Approximately 10.22 tons per day, or 73 percent, would be generated by institutional (educational) and residential reuses.

Energy

Electricity. Reuse-related demands of 105.61 MWH per day would increase electrical consumption in the ROI to 1,251.71 MWH per day. This increase of 9.21 percent over the No-Action Alternative projections would be adequately met by electrical purveyors.

By 2015, this alternative would create an electrical demand on base of 94 MWH per day, compared to 15 MWH per day at closure. Approximately 72 percent of the electrical demand would be created by the institutional (educational) and residential reuses. Once specific proposals are identified, improvements can be negotiated with UPPCO. Individual facilities would need to be metered and appropriate utility corridors and easements would need to be established.

Natural Gas. The average daily natural gas demand in the ROI by 2015 is expected to be 11.37 MMCF per day, which includes a reuse-related

average daily demand of 1.08 MMCF per day. Natural gas demands in the ROI under the No-Action Alternative are forecast to be 10.29 MMCF per day by 2015. The increase of 10.50 percent would be adequately met by the supplies of Michigan Gas Company and Michigan Consolidated Gas Company.

Reuse-related natural gas consumption on base would be 0.9 MMCF per day by 2015. Approximately 0.66 MMCF per day, or 74 percent, would be consumed by industrial and institutional (educational) reuses. The existing on-base natural gas distribution would require some changes to accommodate the reuse of the base, including the installation of individual gas meters at most facilities. Appropriate utility corridors and easements would also have to be established.

Mitigation Measures. No substantial adverse environmental impacts are anticipated under this alternative; therefore, no mitigation measures are required.

4.2.4.4 Recreation Alternative. Table 4.2-7 presents a summary of ROI utility demands and percentage increases associated with this alternative.

Water Consumption. The total average daily water demand in the ROI by 2015 is expected to be 3.37 MGD, which includes a reuse-related average daily water demand of 0.27 MGD. Within the ROI, the communities have a capacity to treat a total of 11.3 MGD of water and have adequate capacity to meet the demands associated with this alternative.

Reuse-related average daily water demand on the base would total 0.2 MGD. This is an increase of 0.18 MGD from the 0.02 MGD at closure. Approximately 0.16 MGD, or 79 percent, is expected to be used by institutional (educational) and residential reuses. Other reuse-related water demand includes the golf course. Reuse of the on-base water system may require certain improvements depending on the type and location of development that occurs. Once specific development proposals are identified, improvements can be designed.

Wastewater. This alternative would increase the total projected wastewater flow in the ROI over the No-Action Alternative projections by 0.21 MGD, or 5.69 percent, to 3.9 MGD by 2015. The ROI has a wastewater treatment capacity of 8.4 MGD.

Wastewater flows on base would increase from 0.01 MGD in 1995 to 0.1 MGD by 2015. The base WWTP has the capability to process up to 2.5 MGD. Approximately 0.09 MGD, or 91 percent, is expected to be produced by institutional (educational) and residential reuses. Effects to the WWTP because of reduced flows under this alternative would be similar to the Proposed Action.

Solid Waste. With the Recreation Alternative, solid waste disposal rates in the ROI would increase to 185.41 tons per day by 2015, compared to 179.70 tons per day with the No-Action Alternative. The life span of the existing Marquette County Landfill would be only slightly affected with this 3.18 percent increase.

Reuse-related solid waste generated on base, included in the amount above, would be 4 tons per day in 2015, compared to 0.15 ton per day at closure. Approximately 2.8 tons per day, or 70 percent, would be generated by institutional (educational) and residential reuses.

Energy

Electricity. Reuse-related demands of 25.59 MWH per day would increase electrical consumption in the ROI to 1,171.69 MWH per day. This increase of 2.23 percent over the No-Action Alternative projections would be adequately met by electrical purveyors.

By 2015, this alternative would create an electrical demand on base of 21 MWH per day, compared to 15 MWH per day at closure. Approximately 67 percent of the electrical demand would be created by the institutional (educational) and residential reuses. Once specific proposals are identified, improvements can be negotiated with UPPCO. Individual facilities would need to be metered, and appropriate utility corridors and easements would need to be established.

Natural Gas. The Recreation Alternative would generate a demand of 1.09 MMCF per day in the ROI by 2015. Much of this demand is associated with the conversion of the existing heating plant to a natural gas-fired power plant. This increase in natural gas consumption of 10.59 percent over the No-Action Alternative would be adequately met by the supplies of Michigan Gas Company and Michigan Consolidated Gas Company.

Reuse-related natural gas consumption on base would be 1.0 MMCF per day by 2015. Approximately 0.87 MMCF per day, or 87 percent, would be consumed by industrial and residential reuses. The existing on-base natural gas distribution would require some changes to accommodate the reuse of the base, including the installation of individual gas meters at most facilities. Appropriate utility corridors and easements would also have to be established.

Mitigation Measures. No substantial adverse environmental impacts are anticipated under this alternative; therefore, no mitigation measures are required.

4.2.4.5 No-Action Alternative. Under the No-Action Alternative, utility use would be minimal in comparison to the other reuse alternatives (see

Table 4.2-7). The disuse of a portion of the on-base utility systems, however, could result in their deterioration over the long term. This deterioration is not expected to cause any environmental impacts. The following ROI utility use is forecast using per capita factors developed from data provided by the utility providers in the study area and would occur without reuse of the base:

- Water consumption in the ROI is projected to increase from 2.79 MGD in 1995 to 3.10 MGD in 2015.

- Wastewater generation in the ROI is projected to increase from 3.13 MGD in 1995 to 3.69 MGD in 2015.

- Solid waste generation in Marquette County is expected to increase from 124.95 tons per day in 1995 to 179.7 tons per day in 2015.

- Electricity consumption in the ROI is projected to increase from 939.5 MWH per day in 1995 to 1,146.1 MWH per day in 2015.

- Natural gas consumption is expected to increase from 8.44 MMCF per day in 1995 to 10.29 MMCF per day in 2015.

4.2.4.6 Other Land Use Concepts. Changes in utility use are measured by land use and employment projections associated with a given plan. Impacts of the proposed independent land use concepts are discussed below relative to each alternative.

Michigan Army National Guard. By 2015, this independent land use would result in utility demands of 0.01 MGD for water, 0.01 MGD for wastewater, 0.03 ton per day for solid waste, 2 MWH per day for electricity, and 0.01 MMCF per day for natural gas. In combination with any of the alternatives, implementation of the MANG land use would result in a net increase in consumption. Impacts would be similar to those described for each alternative.

Correctional Institution. By 2015, this independent land use concept would result in utility demands of 0.35 MGD for water, 0.3 MGD for wastewater, 3.2 tons per day for solid waste, 12 MWH per day for electricity, and 1,190 MMCF per day for natural gas. In combination with the Proposed Action, the correctional institution would result in a net increase in water usage and wastewater generation and a net decrease for all other utility requirements. Under the remaining alternatives, this land use concept would result in a net increase for all utility consumption. Impacts would be similar to those described for the Proposed Action and alternatives.

Sawmill. By 2015, this land use concept would result in utility demands of 0.1 MGD for water, 0.1 MGD for wastewater, 2 tons/day for solid waste, 3 MWH/day for electricity, and 0.04 MMCF/day for natural gas. In

combination with the Proposed Action and International Wayport and Commercial Aviation alternatives, the sawmill would result in no net change in utility consumption. There would be a net increase in utility consumption under the Recreation Alternative. Impacts would be similar to those described for each alternative.

Waste to Energy/Recycling. By 2015, this land use concept would result in utility demands of 0.004 MGD for water, 0.001 MGD for wastewater, and 0.004 MMCF per day of natural gas. Because this concept is a waste to energy operation, solid waste to local landfills would be reduced and the operation would generate electricity. Impacts would be similar to those described for each alternative, except there would be a reduction in solid waste to Marquette County Landfill and in electrical use within the ROI. Based on similar waste to energy facilities, the ash waste generated from the incineration process should be below accepted contaminant levels and could be transported to Marquette County Landfill for disposal.

Waste to Energy/Environmental Support Operations. By 2015, this land use concept would result in utility demands of 0.5 MGD for water, 0.002 MGD for wastewater and 0.04 MMCF per day of natural gas. Because this concept is a waste to energy operation, solid waste to local landfills would be reduced and the operation would generate electricity. Impacts would be similar to those described for each alternative, except there would be a reduction in solid waste to Marquette County Landfill and in use of electricity. Based on similar waste to energy facilities, the ash waste generated from the incineration process should be below accepted contaminant levels and could be transported to Marquette County Landfill for disposal.

4.3 HAZARDOUS MATERIALS AND HAZARDOUS WASTE MANAGEMENT

This section addresses the potential impacts of existing contaminated sites on the various reuse options, and the potential for environmental impacts caused by hazardous materials/waste management practices associated with the reuse options. Hazardous materials/wastes, IRP sites, storage tanks, asbestos, pesticides, PCBs, radon, medical/biohazardous wastes, ordnance, and lead-based paint are discussed within this section.

The U.S. Air Force is committed to the remediation of all contamination at K. I. Sawyer AFB due to past Air Force activities. The OL will remain after base closure to coordinate remediation activities. Delays or restrictions in disposal and reuse of property may occur due to the extent of contamination and the results of both the risk assessment and remedial designs determined for contaminated sites. Examples of conditions resulting in land use restrictions would be the capping of landfills and the constraints from methane generation and cap integrity, as well as the location of long-term monitoring wells. These conditions would have to be considered in the

layout of future development. Options to recipients include creation of parks, greenbelts, or open spaces over these areas.

Regulatory standards and guidelines have been applied in determining the impacts caused by hazardous materials/waste. The following criteria were used to identify potential impacts:

- Accidental release of friable asbestos or lead-based paint during the demolition or modification of a structure

- Generation of 100 kilograms (or more) of hazardous waste in a calendar month, resulting in increased regulatory requirements under MERA 307

- New operational requirements or service for all UST and tank systems

- Any spill or release of a reportable quantity of a hazardous material

- Manufacturing of any compound that requires notifying the pertinent regulatory agency

- Exposure of the environment or public to any hazardous material through release or disposal practices.

4.3.1 Proposed Action

4.3.1.1 Hazardous Materials Management. The hazardous materials likely to be utilized for activities occupying the proposed land use zones are identified in Table 4.3-1. The types and quantities of hazardous materials used would be similar to those used by the base prior to closure. The quantity of hazardous materials utilized under the Proposed Action would increase over the baseline conditions at closure due to an increase in airfield, aviation support, and industrial land uses, and, to a lesser degree, institutional, commercial, residential, public facilities/recreation, and military land uses. The specific chemical compositions and exact use rates are not known.

If the Proposed Action were implemented, each separate organization would be responsible for the management of hazardous materials according to applicable regulations. Additionally, each organization would have to comply with the EPCRA by notifying the Marquette County Local Emergency Planning Committee of the use of extremely hazardous materials. Management of hazardous materials would be in accordance with all applicable regulations, and no unacceptable impacts would result.

4.3.1.2 Hazardous Waste Management. Hazardous wastes under the Proposed Action would be generated from the hazardous materials and the

Table 4.3-1. Hazardous Material Usage by Land Use - Proposed Action

Land Use	Operation Process	Hazardous Materials
Airfield	Aircraft refueling; utilization of clear zones, runways, and taxiways	Aviation fuels, glycols, hydraulic fluids, POL
Aviation support	Operations associated with aircraft maintenance, air cargo, transportation-related industries, and warehousing; manufacturing; administrative offices; governmental administrative services; airport terminal parking; cargo, commercial passenger terminal, corporate, and private aviation support facilities (e.g., air traffic control tower, fuel storage area, fire station), military transient aircraft	Aerosols, aviation fuels, batteries, corrosives, degreasers, glycols, heating oils, hydraulic fluids, ignitables, motor fuels, paints, pesticides, plating chemicals, POL, reactives, solvents, thinners
Industrial	Activities associated with diversified industrial uses; supporting commercial activities, warehousing, and offices	Aerosols, cleaners, corrosives, degreasers, heating oil, hydraulic fluids, ignitables, motor fuels, paints, pesticides, plating chemicals, POL, solvents, thinners
Institutional (medical)	Hospital/clinic, X-ray unit	Heating oils, household products, pharmaceuticals, radiological sources
Institutional (educational)	Preschool, Youth Center, Child Care Center	Heating oils, household products, paints, pesticides, POL, thinners
Commercial	Activities associated with offices and back offices	Heating oils, household products, paints, pesticides, thinners
Residential	Utilization/maintenance of single-family and multi-family units, landscaping, shoppette, preschool activities	Cleaners, fertilizers, household products, motor fuels, oils, pesticides
Public facilities/ recreation	Maintenance of existing recreational facilities, including indoor (gymnasium, swimming pool, bowling center) and outdoor (Little Trout Lake, small arms firing range, golf course, ball fields) facilities	Aerosols, chlorine, cleaners, fertilizers, heating oils, motor fuels, paints, pesticides, POL, small arms ammunition, solvents, thinners
Military	Michigan Army National Guard and U.S. Army Reserve	Batteries, cleaners, corrosives, glycols, household products, ignitables, paint, motor fuels, POL, small arms ammunition, solvents, thinners

POL = petroleum, oil, and lubricants

processes that utilize these materials (see Table 4.3-1). Generated wastes would include POL, fuels, solvents, batteries, paints, and thinners.

Activities associated with the Proposed Action would lead to an increase in the amount of hazardous waste generated compared to the closure baseline. This increase would occur largely from the airfield, aviation support, and industrial land uses. However, hazardous wastes would not create any unacceptable impacts if managed in accordance with all applicable regulations. In addition, each owner/operator would be required to obtain the appropriate permits for generation and disposal of hazardous waste.

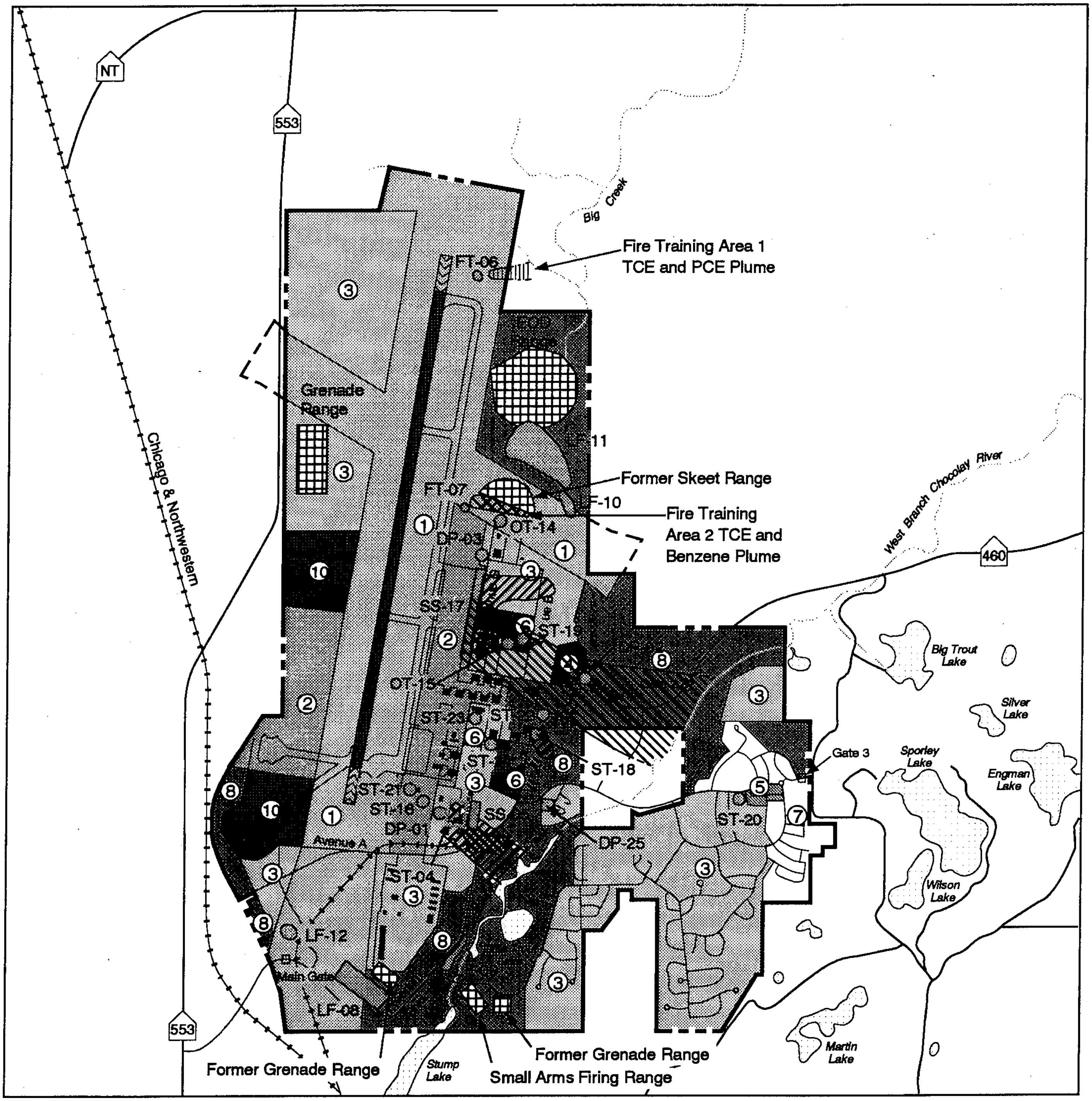
Upon disposal of parcels, hazardous wastes would fall under the control of each property recipient. The presence of numerous independent owners/ operators on the base would change the regulatory requirements. Once the responsibilities of hazardous waste management are allocated to the individual organizations, proficiency with handling and spill responses for those materials is required by OSHA regulations (29 CFR). Mutual aid agreements with surrounding communities may require additional scrutiny and training of emergency staff.

Disposal may be delayed, and reuse of some K. I. Sawyer AFB properties may be restricted based on the investigation and subsequent remediation of SWMUs and AOCs that are determined to pose a threat to human health or the environment.

4.3.1.3 Installation Restoration Program. The U.S. Air Force is committed to continue IRP activities at K. I. Sawyer AFB under DERP. Coordination and management of these activities will be the responsibility of the OL.

The type of development that is appropriate for property adjacent to or over an IRP site may be limited by the risk to human health and the environment posed by contaminants at the site. For example, residential development over an IRP landfill is generally not appropriate. The risk posed by IRP sites is measured by a risk assessment that analyzes the types of substances present at a site and the potential means by which the public and the environment may be exposed to them. The RD, or blueprint for remediating the IRP site, considers the results of the risk assessment and the geographical extent of the contamination.

Disposal by deed may be delayed, and reuse of some K. I. Sawyer AFB properties may be restricted by the extent and type of contamination at IRP sites and by current and future IRP remediation activities (Figure 4.3-1). Based on the results of IRP investigations, the Air Force may, where appropriate, place limits on land reuse through deed restrictions on conveyances and use restrictions on leases. The Air Force may also retain right of access to other properties to inspect monitoring wells or conduct



EXPLANATION

- ① Airfield
- ② Aviation Support
- ③ Industrial
- ④ Institutional (Medical)
- ⑤ Institutional (Educational)
- ⑥ Commercial
- ⑦ Residential
- ⑧ Public Facilities/ Recreation
- ⑨ Agriculture*
- ⑩ Military
- IRP Site
- Benzene in Groundwater
- TCE in Groundwater
- Free Product Plume (JP-4)
- Ordnance Related Ranges
- TCE and PCE in Groundwater
- Base Boundary

0 950 1900 3800 Feet

Note: Plume boundaries not fully characterized.
* Standard land use designation not applicable to this figure.

IRP Sites and Related Groundwater Contamination; EOD Range, Grenade Ranges, and Small Arms Firing Range - Proposed Action

Figure 4.3-1

other remedial activities. The IRP sites within each land use area for the Proposed Action are discussed below and summarized in Table 4.3-2.

Table 4.3-2. IRP Sites within Land Use Areas - Proposed Action

Proposed Land Use	IRP Sites
Airfield	FT-06, FT-07, LF-08, LF-10, LF-12, OT-14, Fire Training Area 1 TCE and PCE Plume, Fire Training Area 2 TCE and Benzene Plume
Aviation support	DP-03, FT-07, SS-17, ST-04, ST-16, ST-21, Central Base TCE Plume, Central Base Benzene Plume, POL Area Benzene Plume, JP-4 Free Product Plume
Industrial	DP-01, DP-03, DP-25, SS-05, ST-20, ST-23, ST-24, Central Base TCE Plume, Central Base Benzene Plume, POL Area Benzene Plume, JP-4 Free Product Plume
Institutional (medical)	Central Base TCE Plume
Institutional (educational)	None
Commercial	OT-15, ST-19, Central Base TCE Plume, Central Base Benzene Plume
Residential	None
Public facilities/recreation	DP-02, LF-08, LF-09, LF-10, LF-11, ST-18, ST-22, Central Base TCE Plume, POL Area Benzene Plume, JP-4 Free Product Plume, BX Service Station Benzene Plume
Military	None

BX = Base Exchange
IRP = Installation Restoration Program
PCE = tetrachloroethane
POL = petroleum, oil, and lubricants
TCE = trichloroethylene

Airfield. Current remediation activities at Sites FT-06 and FT-07, including remediation of the associated groundwater plumes, should not result in any impacts to flight operations. However, delays in property disposal by deed may occur as a result of ongoing remediation and long-term monitoring activities. Remediation of Site LF-08 should not impact flight operations. Remediation and long-term monitoring of Site LF-10 should be completed prior to construction of the crosswind runway. Site LF-12 and Site OT-14 have been approved by regulators for no further action; therefore, no reuse impacts are anticipated at these sites.

Aviation Support. Delays in property disposal by deed and implementation of land use restrictions may result from IRP investigations, remediation activities, and long-term monitoring associated with six sites within this land use area. Delays and restrictions may occur at Sites FT-07 and ST-04, where soil bioventing is under way, and the Central Base TCE Plume, where

a groundwater pump-and-treat system is in place. Similar impacts could result from long-term monitoring and remediation of the Central Base Benzene, POL Area Benzene, and JP-4 Free Product plumes, which also underlie the aviation support land use area. Ongoing investigations and possible remediation activities for Sites ST-16, SS-17, and ST-21 could delay property transfer. Contaminated soils have been removed from Site DP-03; the site has been recommended for no further action, and no impacts to reuse are anticipated.

Industrial. Delays in property disposal by deed may occur as a result of remediation of Sites DP-25, ST-20 (eastern portion of base), ST-23, and ST-24. Bioventing is under way at Sites DP-01 and SS-05 and should not impact reuse; however, if additional site remediation is required, such activities could delay property disposal by deed. Land use restrictions or delays in property disposal by deed could also result from remedial activities or long-term monitoring associated with the Central Base TCE, Central Base Benzene, POL Area Benzene, and JP-4 Free Product plumes. Contaminated soils have been removed from Site DP-03; the site has been recommended for no further action, and no impacts to reuse are anticipated.

Institutional (Medical). Some land use restrictions may result from monitoring and remediation activities associated with the Central Base TCE Plume; however, these activities should not impact reuse of the base hospital (Building 850).

Institutional (Educational). There are no IRP sites within the proposed institutional (educational) land use area.

Commercial. Site OT-15 has been approved for no further action; therefore, no impacts to reuse are anticipated from this site. Delays in property disposal by deed may result from remedial activities at Site ST-19. Both land use restrictions and delays in property disposal by deed may result from remediation and long-term monitoring activities associated with TCE and benzene groundwater contamination in the central base area.

Residential. There are no IRP sites within the proposed residential land use area.

Public Facilities/Recreation. Remediation activities and long-term monitoring activities associated with seven IRP sites and four groundwater contamination plumes could result in some delays in property disposal by deed and reuse, as well as land use restriction. However, based on the overall acreage and anticipated reuse activities associated with this land use, impacts due to IRP activities would be considered minor. Site ST-22 has been approved for no further action; therefore, no reuse impacts from this site are anticipated.

Military. There are no IRP sites within the proposed military land use area.

Determination of future base land uses will be, to a certain extent, dependent upon a regulatory review of the remedial design of the IRP sites. This review will identify current monitoring well locations and future land use limitations as a result of their presence. The regulatory review process includes notifying the FAA of construction and locations of any monitoring wells within the airfield. The RAB will review and provide comments on proposed remedial actions and act as the liaison between the local community and the Air Force during environmental restoration.

4.3.1.4 Storage Tanks. Aircraft flight and maintenance operations, as well as industrial and other land use activities, considered under the Proposed Action would require both USTs and aboveground storage tanks. Reused and new USTs and aboveground storage tanks that would be required by the new owners/operators would be subject to all applicable federal, state, and local regulations. These regulations include acceptable leak detection methodologies, spill and overfill protection, cathodic protection, secondary containment for the tank systems, including the piping and liability insurance. Oil/water separators and aboveground storage tanks to be reused would be managed in accordance with applicable regulations and would cause no impacts. USTs that would not be used to support reuse activities would be closed in conformance with Subpart G of the Michigan UST regulations. Aboveground storage tanks not used to support reuse activities would be emptied, purged of fumes to preclude fire hazards, and secured. Oil/water separators that would not be reused would be pumped and cleaned and closed in accordance with applicable regulations. If closed in place, drained, washed, and capped in accordance with the National Fire Protection Association rules, Chapter 30, the hydrant fueling system would not impact flight operations. However, if removal is required for reuse, the hydrant fueling system would impact the reuse of the former SAC operational apron, as well as the infrastructure adjacent to the on-base fuel transfer line.

4.3.1.5 Asbestos. Renovation and demolition of existing structures with ACM may occur with reuse development. Such activities would be subject to all applicable federal, state, and local regulations to minimize the potential risks to human health and the environment. Consequently, no impacts would occur as a result of implementation of the Proposed Action. Property recipients would be advised, to the extent known, of the type, condition, and amount of ACM within any real property conveyed.

4.3.1.6 Pesticides. Pesticide usage associated with the Proposed Action would increase from amounts used under closure baseline conditions, as a result of the increase in aviation support, industrial, institutional, commercial, residential, and public facilities/recreation land uses.

Management practices would be subject to FIFRA and state regulations; therefore, no unacceptable impacts are anticipated.

4.3.1.7 Polychlorinated Biphenyls. All federally and state-regulated PCB equipment and PCB-contaminated equipment have been removed and properly disposed of. Therefore, these materials would not create any impacts.

4.3.1.8 Radon. Since all radon screening survey results were below U.S. EPA's recommended mitigation level of 4 pCi/l, there would be no impact on reuse activities.

4.3.1.9 Medical/Biohazardous Waste. Biohazardous materials generated with the reuse of the hospital would be subject to conformance with the Michigan Medical Waste Management Act. The proposed reuse of the base hospital as a clinic should not result in an appreciable change in the generation rates of waste products or disposal requirements from preclosure conditions. Biomedical wastes generated under the Proposed Action would not represent any unacceptable impacts when managed under all applicable regulations.

4.3.1.10 Ordnance. The EOD range and the active and former grenade ranges will be cleared of unexploded ordnance, and the small arms firing range will be cleared of spent bullets prior to property disposal. These facilities and the former skeet range (Figure 4.3-1) have been identified as AOCs (Appendix G) and will be investigated to determine the presence or absence of contamination. Should contaminated soil be identified, property disposal and reuse may be delayed by subsequent investigations or remediation at the EOD, grenade, and small arms firing ranges. However, because of the overall size and reuse activities associated with the recreation and agricultural land use areas, these delays could be considered minor impacts.

If the small arms firing range is reused, the earthen berm at the back of the range could become contaminated with lead from spent bullets. This would not create an impact to reuse and would not create any unacceptable impacts if the range were properly maintained (i.e., bullets removed and properly disposed of on a regular basis).

Any unserviceable ordnance will be transported to other DOD facilities for disposal prior to property transfer.

4.3.1.11 Lead-Based Paint. The Proposed Action would involve the occupation, demolition, and renovation of existing structures that may contain lead-based paints. Occupants of facilities constructed prior to or during 1978 would be advised of this condition if no survey of these facilities has been conducted. Results of lead-based paint surveys of military

family housing and high-priority facilities would be disclosed to new occupants, and lead-based paint would be abated as necessary in accordance with Air Force policy. Demolition or renovation activities would be subject to all applicable federal, state, and local regulations to minimize potential risks to human health and the environment.

4.3.1.12 Mitigation Measures. Because all users would be required to comply with applicable federal, state, and local regulations regarding use, storage, and handling of hazardous substances, these activities would not result in substantial environmental impacts, and no mitigation measures would be required. The IRP is an ongoing process that will continue regardless of base reuse with remedial measures being implemented as part of the ROD for remediation of the IRP site(s). The following measures are provided as a way of further reducing the potential for release of hazardous materials and hazardous waste into the environment and for the implementation of reuse on or near IRP sites.

A cooperative planning body for hazardous materials and waste management could be established with the support of the new individual reuse recipients on the base. Establishment of such a body could reduce the costs of environmental compliance training, health and safety training, and waste management, and could increase recycling, minimize waste, and assist in mutual aid spill responses. Implementation of such a planning body would be the responsibility of all property recipients (i.e., individual owners/ operators).

The scheduling of collection days for household products such as paints, pesticides, and cleaners could mitigate publicly owned treatment works and storm water discharge concerns. Articles in the local papers and classes offered by community educational groups could increase public awareness of recycling, appropriate use of pesticides, waste minimization, and waste disposal. Collection of household products could provide a proper means of disposal of collected items and reduce the amount of hazardous substances released to the environment by placement in domestic landfills, through storm water systems, or by other illicit means. Implementation of disposal of these substances as regulated hazardous waste would be the responsibility of the state or county. Recycling household waste by the property recipients could follow the recommendations of the Michigan Solid Waste Management Act.

Reuser should follow the recommendation of the Bi-National Program to Restore and Protect the Lake Superior Basin which was signed by Governor Engler of Michigan and six other governments in October 1991. The program included the federal governments of the United States and Canada; the states of Minnesota, Wisconsin, and Michigan; and the Province of Ontario. The goal of the program is to commit to zero discharge of environmentally persistent toxic chemicals within the Lake Superior Basin by initiating pollution prevention measures. Under this program, the governments will ensure that their respective regulatory programs are compatible with the attainment of the goal and fair to dischargers on both sides of the basin.

All of the IRP sites may not need to be remediated; however, all of them must be addressed and properly closed out. A proactive land use planning approach to reuse would require coordination and enforcement among the OL, the RAB, and redevelopment authorities in order to reduce potential delays in reuse or redevelopment. Land use impacts could be mitigated by implementing a phased construction schedule. Such an approach would allow for base redevelopment to begin in areas without IRP sites; areas with IRP sites would be developed in a later project phase. Phased redevelopment would allow for IRP site remediation with minimal impacts to redevelopment. Redevelopment activities could be coordinated between the OL and redevelopment authorities in order to identify existing and future locations of groundwater monitoring wells. This would allow for coordinating right-of-egress or establishing easements, as well as preventing redevelopment conflicts with existing monitoring wells. Mitigation measures implemented during construction activities could prevent impacts to nearby IRP sites. For example, excessive surface water runoff as a result of construction activities may degrade a landfill cap or erode and transport (spread) contaminated soils.

Active coordination between the OL and the appropriate jurisdiction's planning department could identify the presence of IRP sites that could limit certain land uses (e.g., landfills). Determination of future land uses would be, to a certain extent, dependent on the level of remediation conducted at individual IRP sites. Areas of restricted land use at IRP sites could be incorporated into the redevelopment plans as greenbelts, parks, or landscaped open spaces.

The presence of lead-based paint will be disclosed to recipients of military family housing (high-priority facilities); the recipients of facilities constructed prior to or during 1978 and not previously surveyed for lead-based paint, will be notified that lead-based paint may be present. Coordination of lead-based paint removal in conjunction with construction or renovation activities could further minimize the risk to human health and the environment.

Coordination of ACM removal or management in conjunction with construction or renovation activities could reduce the number of potential exposures from asbestos. The management of removal of ACM in property disposal by deed would be the responsibility of the property recipient.

4.3.2 International Wayport Alternative

4.3.2.1 Hazardous Materials Management. The hazardous materials likely to be used for activities occupying the proposed land use zones are identified in Table 4.3-3. The types of hazardous materials would be similar to those used by the base prior to closure as well as those utilized under the Proposed Action. The quantity of hazardous materials utilized under the International Wayport Alternative would increase over the baseline

Table 4.3-3. Hazardous Material Usage by Land Use - International Waypoint Alternative

Land Use	Operation Process	Hazardous Materials
Airfield	Aircraft refueling; utilization of clear zones, runways, and taxiways	Aviation fuels, glycols, hydraulic fluids, POL
Aviation support	Operations associated with aircraft maintenance, air cargo, transportation-related industries, and warehousing; manufacturing; administrative offices; governmental administrative services; commercial passenger terminal, airport terminal parking; cargo, corporate, and private aviation support facilities (e.g., air traffic control tower, fuel storage area, fire station)	Aerosols, aviation fuels, batteries, corrosives, degreasers, glycols, heating oils, hydraulic fluids, ignitables, motor fuels, paints, pesticides, plating chemicals, POL, reactives, solvents, thinners
Industrial	Activities associated with diversified industrial uses; manufacturing, warehousing, and offices	Aerosols, cleaners, corrosives, degreasers, heating oil, hydraulic fluids, ignitables, motor fuels, paints, pesticides, plating chemicals, POL, solvents, thinners
Institutional (medical)	Hospital/clinic, X-ray unit, and medical training operations	Heating oils, household products, pharmaceuticals, radiological sources
Institutional (educational)	Vocational and technical training facilities, public education, security and public health training, student housing, administration	Cleaners, corrosives, fertilizers, heating oils, household products, ignitables, motor fuels, paints, pesticides, POL, small arms ammunition, solvents, thinners
Commercial	Activities associated with offices, retail, service industries, service station, restaurants, youth/child care, telecommunication, casino gaming, conference center	Aerosols, batteries, cleaners, corrosives, heating oils, household products, ignitables, motor fuels, paints, pesticides, POL, solvents, thinners
Residential	Utilization/maintenance of single-family and multi-family units, and landscaping	Cleaners, fertilizers, household products, motor fuels, oils, pesticides
Public facilities/ recreation	Maintenance of existing recreational facilities, including indoor (gymnasium, swimming pool, bowling center) and outdoor facilities (Little Trout Lake, golf course, ball fields)	Aerosols, chlorine, cleaners, fertilizers, heating oils, household products, motor fuels, paints, pesticides, POL, solvents, thinners
Agriculture	Timber harvesting	Motor fuels, pesticides, POL

POL = petroleum, oil, and lubricants

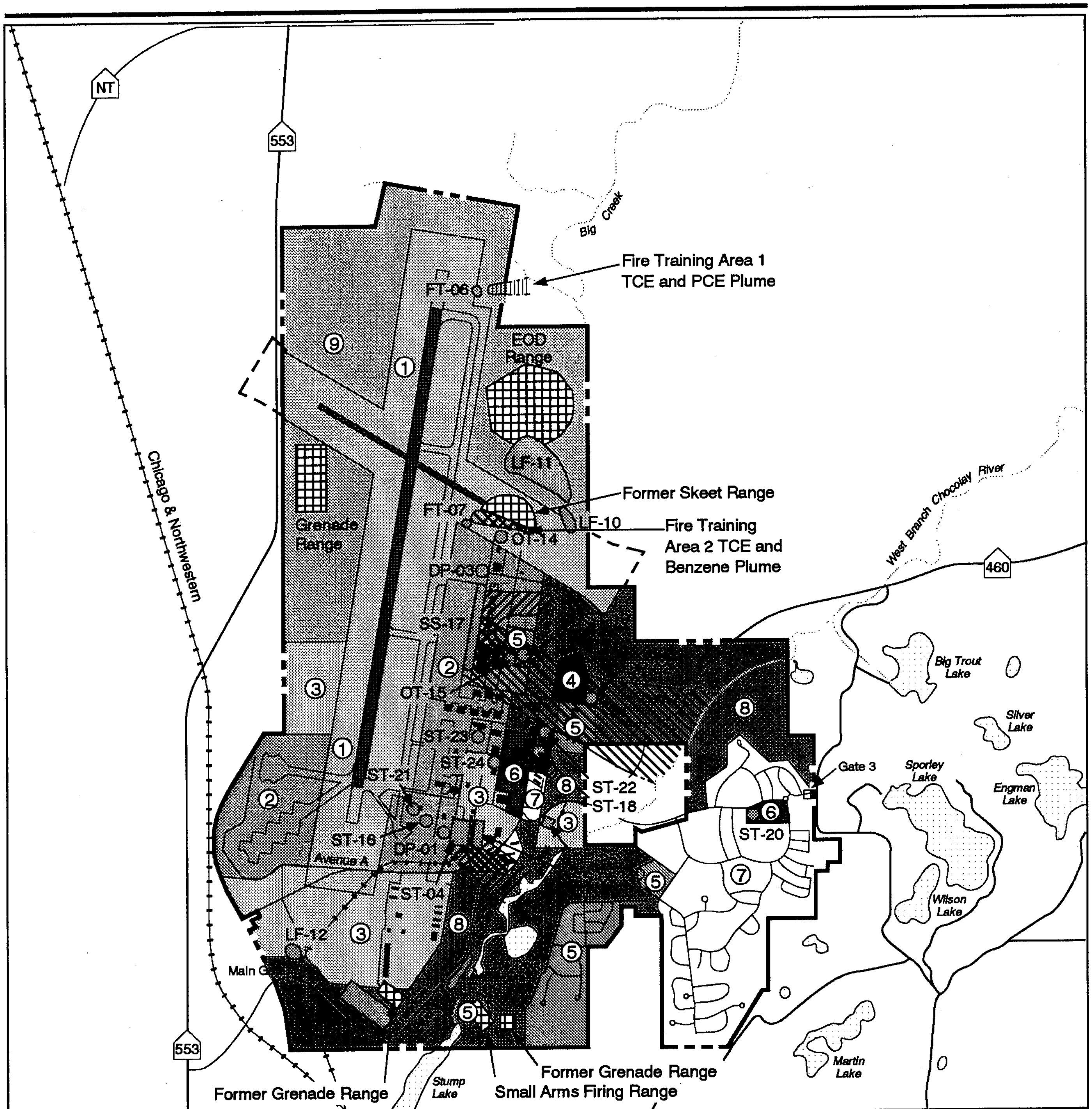
conditions at closure due to an increase in airfield, aviation support, industrial, institutional, and commercial land uses, and, to a lesser degree, residential, public facilities/recreation, and agricultural land uses. The amounts of hazardous materials utilized during aircraft flight and maintenance activities would increase substantially over those used under the Proposed Action. However, hazardous materials used during industrial processes under the International Waypont Alternative are anticipated to be considerably less than those utilized by industrial processes under the Proposed Action, although specific chemical compositions and exact use rates are not known. Management of hazardous materials under all applicable regulations, as discussed under the Proposed Action, would not result in any unacceptable impacts.

4.3.2.2 Hazardous Waste Management. Hazardous wastes under the International Wayport Alternative would be generated from the hazardous materials and the processes that utilize these materials (Table 4.3-3). Generated wastes would include POL, fuels, solvents, batteries, paints, and thinners. Under the International Wayport Alternative, hazardous waste management control, activities, and regulatory requirements from these generated wastes would be similar to those under the Proposed Action.

Activities associated with the International Wayport Alternative would lead to an increase in the amount of hazardous waste generated when compared to the closure baseline. This increase would occur primarily from the airfield, aviation support, industrial, and institutional land uses and to a lesser extent from residential and public facilities/recreation land uses. Although the International Wayport Alternative would generate more aviation-related hazardous waste than the Proposed Action, the amounts of hazardous waste would be similar because more industrial-related hazardous waste would be generated under the Proposed Action. Management of waste utilizing all applicable regulations would preclude any unacceptable impacts under this alternative. In addition, each owner/operator would be required to obtain the appropriate permits for generation and disposal of hazardous waste.

Disposal by deed may be delayed and reuse of some K. I. Sawyer AFB properties may be restricted based on the investigation and subsequent remediation of SWMUs and AOCs that are determined to pose a threat to human health or the environment.

4.3.2.3 Installation Restoration Program. The IRP sites within each land use area for the International Wayport Alternative are identified in Figure 4.3-2 and summarized in Table 4.3-4. The continued IRP activities and the type of appropriate development for property adjacent to IRP sites would be similar to those discussed under the Proposed Action.



EXPLANATION

- ① Airfield
- ② Aviation Support
- ③ Industrial
- ④ Institutional (Medical)
- ⑤ Institutional (Educational)
- ⑥ Commercial
- ⑦ Residential
- ⑧ Public Facilities/ Recreation
- ⑨ Agriculture
- IRP Site
- Benzene in Groundwater
- TCE in Groundwater
- Free Product Plume (JP-4)
- Ordnance Related Ranges
- TCE and PCE in Groundwater
- Base Boundary

0 950 1900 3800 Feet

Note: Plume boundaries not fully characterized.

IRP Sites and Related Groundwater Contamination; EOD Range, Grenade Ranges, and Small Arms Firing Range - International Wayport Alternative

Figure 4.3-2

Table 4.3-4. IRP Sites within Land Use Areas - International Wayport Alternative

Proposed Land Use	IRP Sites
Airfield	FT-06, FT-07, LF-10, OT-14, Fire Training Area 2 TCE and Benzene Plume
Aviation support	DP-01, DP-03, FT-07, SS-17, ST-04, ST-16, ST-21, ST-23, Central Base TCE Plume, Central Base Benzene Plume, POL Area Benzene Plume, JP-4 Free Product Plume
Industrial	DP-25, LF-08, LF-12, SS-05, ST-24, POL Area Benzene Plume, JP-4 Free Product Plume
Institutional (medical)	Central Base TCE Plume
Institutional (educational)	OT-15, ST-19, Central Base TCE Plume, Central Base Benzene Plume
Commercial	ST-18, ST-20, ST-22, Central Base TCE Plume, BX Service Station Benzene Plume
Residential	POL Area Benzene Plume, JP-4 Free Product Plume, BX Service Station Benzene Plume
Public facilities/recreation	DP-02, LF-08, LF-09, LF-12, Central Base TCE Plume, Central Base Benzene Plume, POL Area Benzene Plume, JP-4 Free Product Plume, BX Service Station Benzene Plume
Agriculture	FT-06, LF-10, LF-11, Fire Training Area 1 TCE and PCE Plume

BX = Base Exchange
IRP = Installation Restoration Program
PCE = tetrachloroethane
POL = petroleum, oil, and lubricants
TCE = trichloroethylene

Airfield. Current remediation activities at Sites FT-06 and FT-07 and the groundwater plume associated with Fire Training Area 2 should not result in any impacts to flight operations. However, delays in property disposal by deed may occur as a result of ongoing remediation and long-term monitoring activities. Remediation of Site LF-10 would occur prior to construction of the crosswind runway, but land use restrictions could result in order to accommodate long-term monitoring activities. Site OT-14 has been approved for no further action; therefore, no reuse impacts are anticipated.

Aviation Support. Delays in property disposal by deed and implementation of land use restrictions may result from IRP investigations, remediation activities, and long-term monitoring associated with eight sites within this land use area. Delays and restrictions may occur at Sites DP-01, FT-07, and ST-04, where soil bioventing is under way, and the Central Base TCE Plume, where a groundwater pump-and-treat system is in place. Similar impacts could result from long-term monitoring and remediation of the Central Base Benzene, POL Area Benzene, and JP-4 Free Product plumes, which also underlie the aviation support land use area. Ongoing investigations and possible remediation activities for Sites ST-16, SS-17, ST-21, and ST-23 could delay property disposal by deed. However, impacts to reuse may be minor since buildout of aviation support facilities is anticipated to be slow. Site DP-03 has been recommended for no further action; therefore, no impacts to reuse from this site are anticipated.

Industrial. Delays in property disposal by deed may occur as a result of remediation of Sites DP-25, LF-08, and ST-24. Land use restrictions could occur if fill debris remains in place and the landfill is capped. Bioventing is under way for Site SS-05 and should not impact reuse; however, if additional site remediation is required, such activities could delay property reuse and disposal. Land use restrictions or delays in property disposal by deed could also result from remedial activities or long-term monitoring associated with the POL Area Benzene and JP-4 Free Product plumes. Landfill LF-12 has been approved for no further action; therefore, no reuse impacts from this site are anticipated.

Institutional (Medical). Some land use restrictions may result from monitoring and remediation activities associated with the Central Base TCE Plume; however, these activities should not impact reuse of the base hospital (Building 850).

Institutional (Educational). Site OT-15 has been approved for no further action; therefore, no impacts to reuse are anticipated at this site. Delays in property disposal by deed may result from remedial activities at Site ST-19. Both land use restrictions and delays in property disposal by deed may result from remediation and long-term monitoring activities conducted in association with TCE and benzene groundwater contamination in the central base area.

Commercial. Remediation of Sites ST-18 (in the central base area) and ST-20 (in the military family housing area) may result in delays in reuse. Similar delays, as well as land use restrictions, may result from remediation and monitoring programs associated with the Central Base TCE Plume and the Base Exchange Service Station Benzene Plume. No further action has been approved for Site ST-22 and no impacts to reuse from this site are anticipated.

Residential. Some land use restrictions may result from long-term groundwater monitoring programs and remediation activities associated with the POL Area Benzene, JP-4 Free Product, and Base Exchange Service Station Benzene plumes; however, these activities should not impact reuse of the VOQ and dormitories in the central portion of the base. No IRP sites are within the proposed residential land use area in the southeast portion of the base.

Public Facilities/Recreation. Remediation activities and long-term monitoring activities associated with Sites DP-02, LF-08, and LF-09, and five groundwater contamination plumes could result in some delays in property disposal by deed and reuse, as well as land use restrictions. However, based on the overall acreage and reuse activities associated with this land use, impacts due to IRP activities would be considered minor. Landfill LF-12 has been approved for no further action; therefore, no reuse impacts are anticipated.

Agriculture. Ongoing and future remediation activities and any long-term monitoring programs associated with Sites FT-06 (including the Fire Training Area 1 TCE and PCE plume), LF-10, and LF-11 could result in some delays in property disposal by deed and implementation of land use restrictions. However, these restrictions and/or delays would be considered only minor impacts, considering the total area proposed for agricultural reuse.

4.3.2.4 Storage Tanks. Aircraft flight and maintenance operations, as well as industrial, commercial, and other proposed land uses, under the International Wayport Alternative would require both USTs and aboveground storage tanks. New and existing storage tanks would be required by new owners/operators and would be subject to the same federal, state, and local regulations discussed under the Proposed Action. Oil/water separators to be reused would be managed in accordance with applicable regulations and would cause no impacts.

Aboveground storage tanks not used to support reuse activities would be emptied, purged of fumes to preclude fire hazards, and secured. Under this alternative, closure of USTs, aboveground storage tanks, and oil/water separators would be in accordance with applicable regulations similar to those discussed under the Proposed Action. The hydrant fueling system would be closed in accordance with applicable regulations. Impacts associated with the closure of the hydrant fueling system would be similar to those discussed under the Proposed Action.

4.3.2.5 Asbestos. Renovation and demolition of existing structures with ACM may occur with reuse development. The square footage of facilities identified for demolition under the International Wayport Alternative is considerably less than under the Proposed Action; therefore, the amount of ACM removal and disposal would be less than similar activities under the

Proposed Action. Such activities would be subject to all applicable federal, state, and local regulations to minimize the potential risks to human health and the environment. Consequently, no impacts would occur as a result of these activities. Property recipients would be advised, to the extent known, of the type, condition, and amount of ACM within any real property conveyed.

4.3.2.6 Pesticides. Pesticide usage associated with the International Wayport Alternative would increase from amounts used under closure baseline conditions, as a result of the increase in aviation support, industrial, institutional, commercial, residential, public facilities/recreation, and agricultural land uses. Pesticide usage could also increase over the amount used under the Proposed Action as a result of increased residential and agricultural land uses. Management practices would be subject to FIFRA and state regulations; therefore, no unacceptable impacts are anticipated.

4.3.2.7 Polychlorinated Biphenyls. All federally and state-regulated PCB equipment and PCB-contaminated equipment have been removed and properly disposed of; therefore, these materials would not create any impacts.

4.3.2.8 Radon. Since all radon screening survey results were below the U.S. EPA's recommended mitigation level of 4 pCi/l, there would be no impact on reuse activities.

4.3.2.9 Medical/Biohazardous Waste. The amount of medical/biohazardous waste generated under the International Wayport Alternative would be similar to the quantity generated under the Proposed Action. All medical/biohazardous waste under this alternative would be managed as described for the Proposed Action. Biomedical wastes generated under the International Wayport Alternative would not represent any unacceptable impacts when managed under all applicable regulations.

4.3.2.10 Ordnance. Management of ordnance-related facilities would be similar to that identified under the Proposed Action. Because of the overall acreage and reuse activities associated with the recreational and agriculture land use areas, no impacts resulting from investigation or remediation of ordnance-related facilities are anticipated. Remediation of the former skeet range should be completed prior to construction of the crosswind runway. Reuse of the small arms firing range may be delayed in order to remove spent bullets and, if necessary, remediate contaminated soils. Management under reuse of the small arms firing range would be similar to that identified under the Proposed Action.

4.3.2.11 Lead-Based Paint. Management of lead-based paint under this alternative would be similar to that identified under the Proposed Action.

4.3.2.12 Mitigation Measures. Measures for this alternative would be similar to those identified under the Proposed Action.

4.3.3 Commercial Aviation Alternative

4.3.3.1 Hazardous Materials Management. The types of hazardous materials used under the Commercial Aviation Alternative are provided in Table 4.3-5, and would be similar to those used under the Proposed Action and International Wayport Alternative. The quantities used under this alternative would increase over the amounts used at closure due to the establishment of airfield, aviation support, industrial, institutional, commercial, and residential land uses, and, to a lesser extent, recreational and agricultural land uses. Quantities of hazardous materials utilized under this alternative would be less than the amounts used for the Proposed Action due to a decrease in flight operations and a 67 percent decrease in industrial land use acreage. Hazardous material usage would also decrease compared to the International Wayport Alternative due to the substantial decrease in flight operations and associated aviation support activities. Management of these materials under all applicable regulations, as discussed under the Proposed Action, would not create any unacceptable impacts.

4.3.3.2 Hazardous Waste Management. Under the Commercial Aviation Alternative, hazardous wastes would be generated from the hazardous materials and processes used (see Table 4.3-5) and would include waste POL, solvents, corrosives, paints, and thinners. Under the Commercial Aviation Alternative, hazardous waste management control, activities, and regulatory requirements from these generated wastes would be similar to those under the Proposed Action.

Activities associated with the Commercial Aviation Alternative would lead to an increase in the amount of hazardous waste generated when compared to the closure baseline, but would be less than the amounts generated under the Proposed Action and International Wayport Alternative. This is due to a decrease in flight operations, and aviation support and industrial activities. The hazardous waste generated under this alternative would be primarily from airfield, aviation support, industrial, and institutional uses. Management of waste utilizing all applicable regulations would preclude any unacceptable impacts under this alternative. In addition, each owner/ operator would be required to obtain the appropriate permits for generation and disposal of hazardous waste.

Disposal by deed may be delayed and reuse of some K. I. Sawyer AFB properties may be restricted based on the investigation and subsequent remediation of SWMUs and AOCs that are determined to pose a threat to human health or the environment.

Table 4.3-5. Hazardous Material Usage by Land Use - Commercial Aviation Alternative

Land Use	Operation Process	Hazardous Materials
Airfield	Aircraft refueling; utilization of clear zones, runways, and taxiways	Aviation fuels, glycols, hydraulic fluids, POL
Aviation support	Operations associated with aircraft maintenance, air cargo, transportation-related industries, and warehousing; manufacturing; administrative offices; governmental administrative services; commercial passenger terminal, airport terminal parking; corporate, and private aviation support facilities (e.g., air traffic control tower, fuel storage area, fire station)	Aerosols, aviation fuels, batteries corrosives, degreasers, glycols, heating oils, hydraulic fluids, ignitables, motor fuels, paints, pesticides, plating chemicals, POL, reactives, solvents, thinners
Industrial	Activities associated with manufacturing, warehousing, storage, and corporate office	Aerosols, cleaners, corrosives, degreasers, heating oils, hydraulic fluids, ignitables, motor fuels, paints, pesticides, plating chemicals, POL, solvents, thinners
Institutional (educational)	Vocational training (search and rescue, heat and sewage plant management, golf course management, forestry management, mining operations), medical aid, Child Care Center, Youth Center, student housing	Batteries, cleaners, corrosives, fertilizers, heating oils, household products, motor fuels, paints, pesticides, pharmaceuticals, POL, radiological sources, small arms ammunition, thinners, water softening chemicals
Commercial	Activities associated with neighborhood retail center, service industries, office space	Aerosols, corrosives, heating oils, household products, paints, pesticides, POL, thinners
Residential	Utilization/maintenance of single-family units, multi-family units, landscaping, seasonal resort housing	Cleaners, fertilizers, household products, motor fuels, paints, pesticides, POL, thinners
Public facilities/ recreation	Maintenance of existing recreational facilities including outdoor (the golf course Little Trout Lake, all fields) and indoor (gymnasium, bowling center, swimming pool) facilities	Aerosols, chlorine, cleaners, fertilizers, heating oils, household products, motor fuels, paints, pesticides, POL, thinners
Agriculture	Timber harvesting	Motor fuels, pesticides, POL

POL = petroleum, oil, and lubricants

4.3.3.3 Installation Restoration Program. The IRP sites located within each land use area for the Commercial Aviation Alternative are identified in Figure 4.3-3 and summarized in Table 4.3-6. The continued IRP activities and the type of appropriate development for property adjacent to IRP sites would be similar to those discussed under the Proposed Action.

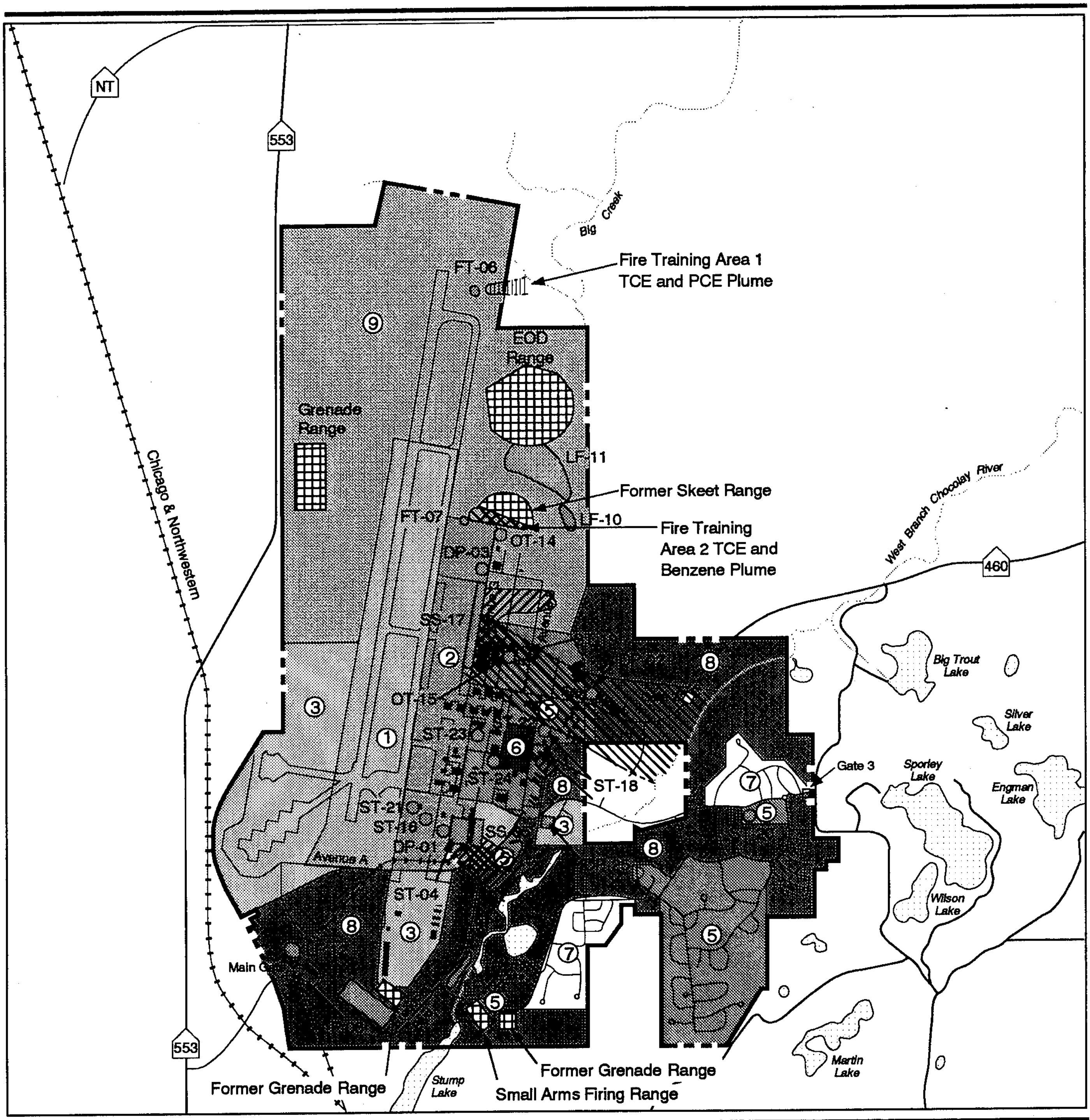
Table 4.3-6. IRP Sites within Land Use Areas - Commercial Aviation Alternative

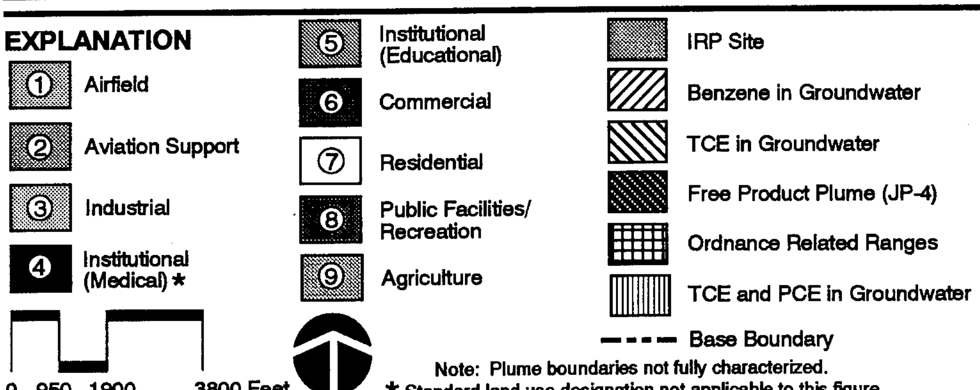
Proposed Land Use	IRP Sites
Airfield	None
Aviation support	DP-01, DP-03, FT-07, SS-17, ST-04, ST-16, ST-21, Central Base TCE Plume, Central Base Benzene Plume, POL Area Benzene Plume, JP-4 Free Product Plume
Industrial	DP-25, SS-05, POL Area Benzene Plume, JP-4 Free Product Plume
Institutional (educational)	OT-15, ST-18, ST-19, ST-20, ST-22, ST-23, ST-24, Central Base TCE Plume, Central Base Benzene Plume, POL Area Benzene Plume, JP-4 Free Product Plume, BX Service Station Benzene Plume
Commercial	None
Residential	None
Public facilities/recreation	DP-02, LF-08, LF-09, LF-12, Central Base TCE Plume, POL Area Benzene Plume, JP-4 Free Product Plume, BX Service Station Benzene Plume
Agriculture	FT-06, FT-07, LF-10, LF-11, OT-14, Central Base TCE Plume, Central Base Benzene Plume, Fire Training Area 1 TCE and PCE Plume, Fire Training Area 2 TCE and Benzene Plume

BX = Base Exchange
IRP = Installation Restoration Program
PCE = tetrachloroethane
POL = petroleum, oil, and lubricants
TCE = trichloroethylene

Airfield. There are no IRP sites within the proposed airfield land use area.

Aviation Support. Delays in property disposal by deed and implementation of land use restrictions may occur as a result of ongoing and future remediation and long-term monitoring of the Central Base TCE, Central Base Benzene, POL Area Benzene, and JP-4 Free Product plumes. Similar impacts may result at Sites DP-01, FT-07, and ST-04 which are currently undergoing soil bioventing, and Sites ST-16 and ST-21. Remediation of Site SS-17 could impact reuse of the former SAC operational apron. Site DP-03 has been recommended for no further action following a soil removal project; therefore, no impacts to reuse from this site are anticipated.





IRP Sites and Related Groundwater Contamination; EOD Range, Grenade Ranges, and Small Arms Firing Range - Commercial Aviation Alternative

Figure 4.3-3

Industrial. Delays in property disposal by deed and implementation of land use restrictions could occur as a result of ongoing and future remediation and long-term monitoring activities at Site SS-05 (undergoing soil bioventing) and the POL Area Benzene and JP-4 Free Product plumes. IRP investigations and remediation may result in a delay in property disposal by deed for Site DP-25 at the WWTP. No impacts from IRP remedial activities are anticipated to occur to reuse activities associated with the western and southern (former alert apron and former Weapons Storage Area, respectively) industrial reuse parcels.

Institutional (Educational). Remediation activities and long-term monitoring programs associated with seven IRP sites and five groundwater contamination plumes could result in land use restrictions and delays in reuse. All sites and plumes are within the central base area, with the exception of Site ST-20, which is in the eastern portion of the base. Sites OT-15 and ST-22 have been approved for no further action; therefore, no reuse impacts are anticipated.

Commercial. There are no IRP sites within the proposed commercial land use area.

Residential. There are no IRP sites within the proposed residential land use area.

Public Facilities/Recreation. Remediation of Sites LF-08 and LF-09, located in the south base area, and Site DP-02, located in the central base area, may result in delays in property disposal by deed and reuse. Ongoing and future remediation activities associated with the Central Base TCE Plume, and future groundwater remediation of the POL Area Benzene, JP-4 Free Product, and Base Exchange Service Station Benzene plumes could result in land use restrictions and delays in property disposal by deed. However, these restrictions and/or delays would be considered only minor impacts considering the total area proposed for recreational reuse. Site LF-12 has been approved for no further action; therefore, no impacts to reuse are anticipated.

Agriculture. Ongoing remediation at Sites FT-06 and FT-07 and the associated Fire Training plumes, and future remediation activities and any long-term monitoring programs associated with Sites LF-10, LF-11, and the Central Base TCE and Benzene plumes, could result in land use restrictions and delays in area reuse. However, based on the overall size of the proposed agricultural land use area, impacts due to IRP activities would be considered minor. Site OT-14 has been approved for no further action; therefore, no reuse impacts from this site are anticipated.

4.3.3.4 Storage Tanks. Industrial operations and facility heating requirements under the Commercial Aviation Alternative would require both

USTs and aboveground storage tanks. New and existing storage tanks would be required by the new owners/operators associated with industrial, institutional, and commercial land uses, and would be subject to the same federal, state, and local regulations discussed under the Proposed Action. Oil/water separators to be reused would be managed in accordance with applicable regulations.

Aboveground storage tanks not utilized to support reuse activities would be emptied and purged of fumes to preclude fire hazards. Under this alternative, closure of USTs, aboveground storage tanks, and oil/water separators would be in accordance with applicable regulations similar to those discussed under the Proposed Action.

The hydrant fueling system would be closed in accordance with applicable regulations. Impacts associated with the closure of the hydrant fueling system would be similar to those discussed under the Proposed Action.

4.3.3.5 Asbestos. Renovation and demolition of existing structures that contain ACM may occur with reuse development. The square footage of facilities identified for demolition under the Commercial Aviation Alternative is approximately 25 percent less than under the Proposed Action and about eight times greater than under the International Wayport Alternative. ACM abatement is subject to all applicable federal, state, and local regulations to minimize the potential risk to human health and the environment, and no impacts would occur as a result of their implementation under this alternative. Property recipients would be advised, to the extent known, of the type, condition, and amount of ACM within any real property conveyed.

4.3.3.6 Pesticides. Under the Commercial Aviation Alternative, pesticide usage would increase over closure baseline conditions mainly due to an increase in aviation support, industrial, and institutional (educational) land uses, and to a lesser degree residential, public facilities/recreation, and agricultural land uses. Management practices would be subject to FIFRA and state guidelines and, therefore, would not result in any unacceptable impacts.

4.3.3.7 Polychlorinated Biphenyls. All federally and state-regulated PCB equipment and PCB-contaminated equipment have been removed and properly disposed of; therefore, these materials would not create any impacts.

4.3.3.8 Radon. Since all radon screening survey results were below U.S. EPA's recommended mitigation level of 4 pCi/l, there would be no impacts on reuse activities.

4.3.3.9 Medical/Biohazardous Waste. The amount of medical/biohazardous waste generated by hospital aid training under this alternative would be less

than under the Proposed Action. Biomedical wastes generated would not represent any unacceptable impacts when managed under all applicable regulations.

4.3.3.10 Ordnance. Management of the EOD range, the active and former grenade ranges, small arms firing range, and former skeet range would be similar to those practices discussed under the Proposed Action. No ordnance-related impacts to agricultural lands are anticipated because of the overall acreage and reuse activities associated with this land use. However, investigation and remediation activities associated with the small arms firing range could delay property disposal. Management under reuse of the small arms firing range would be similar to the Proposed Action.

4.3.3.11 Lead-Based Paint. Lead-based paint management practices under this alternative would be similar to those identified under the Proposed Action.

4.3.3.12 Mitigation Measures. Measures for this alternative would be similar to those identified under the Proposed Action.

4.3.4 Recreation Alternative

4.3.4.1 Hazardous Materials Management. The types of hazardous materials used under the Recreation Alternative are provided in Table 4.3-7. These would be similar to materials used under the Proposed Action and other alternatives, with the exception of those materials utilized specifically for aviation-related activities. The quantities utilized under this alternative would increase over the amounts utilized at closure, largely due to the establishment of industrial development. Under the Recreation Alternative, the quantities of hazardous materials used would be less than under the Proposed Action, International Wayport Alternative, and the Commercial Aviation Alternative due to the absence of aircraft operations and fewer industrial and institutional activities. Hazardous materials used under this alternative would be primarily associated with industrial, and, to a lesser degree, institutional, commercial, residential, and recreational land uses. Management of hazardous materials under all applicable regulations, as discussed under the Proposed Action, would not result in any unacceptable impacts.

4.3.4.2 Hazardous Waste Management. Hazardous wastes under the Recreation Alternative would be generated mostly from industrial-related hazardous materials and processes (see Table 4.3-7), and could consist of solvents, corrosives, plating waste, POL, fuels, paints, and thinners. Under the Recreation Alternative, hazardous waste management control, activities, and regulatory requirements from these generated wastes would be similar to those under the Proposed Action.

Table 4.3-7. Hazardous Material Usage by Land Use - Recreation Alternative

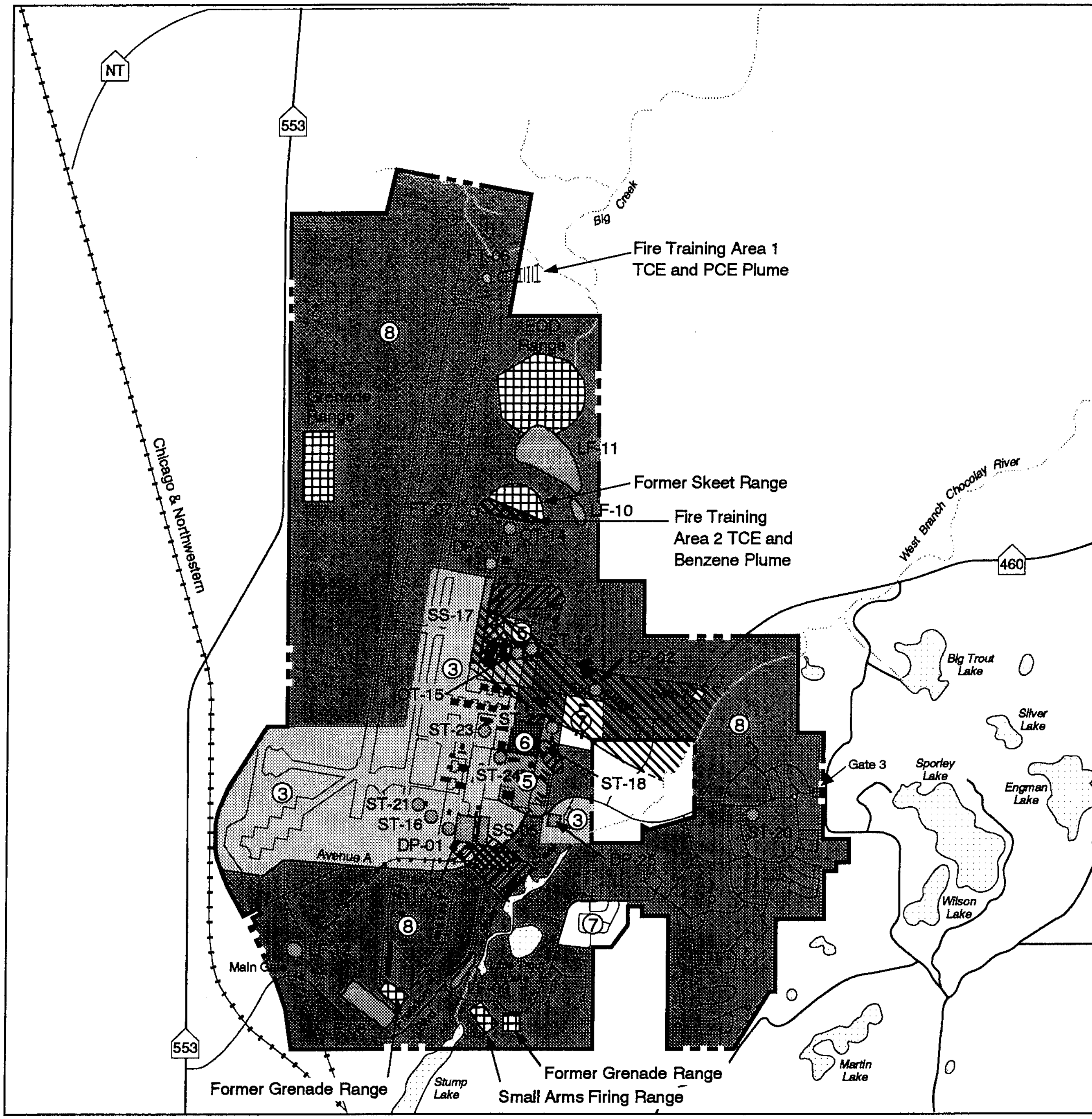
Land Use	Operation Process	Hazardous Materials
Industrial	Activities associated with light industry and manufacturing, warehousing and storage, corporate offices	Aerosols, cleaners, corrosives, degreasers, heating oils, hydraulic fluids, ignitables, motor fuels, paints, pesticides, plating chemicals, POL, reactives, solvents, thinners
Institutional (educational)	Vocational training facilities, student housing, recreation center	Aerosols, cleaners, corrosives, heating oils, household products, ignitables, motor fuels, paints, pesticides, POL, solvents, thinners
Commercial	Activities associated with retail, office, service industries; casino gaming; telecommunications operations; restaurants; financial companies (order processing)	Heating oils, household products, paints, pesticides, thinners
Residential	Utilization/maintenance of single-family and multi-family units, dormitories/ apartments, landscaping	Cleaners, fertilizers, household products, motor fuels, paints, pesticides, POL, thinners
Public facilities/recreation	Maintenance of existing indoor and outdoor recreational facilities including golf course, gymnasium, swimming pools, cultural center, recreational vehicle camping, and other recreational facilities	Aerosols, chlorine, cleaners, fertilizers, heating oils, household products, motor fuels, paints, pesticides, POL, thinners

POL = petroleum, oil, and lubricants

Activities associated with the Recreation Alternative would lead to an increase in the amount of hazardous waste generated when compared to the closure baseline due to the increase in industrial activities. Hazardous waste generation under this alternative would be less than under the Proposed Action and International Wayport and Commercial Aviation alternatives due to the absence of aircraft operations and fewer industrial and/or institutional land use activities. Management of waste utilizing all applicable regulations would preclude any unacceptable impacts under this alternative. In addition, each owner/operator would be required to obtain the appropriate permits for generation and disposal of hazardous waste.

Disposal by deed may be delayed and reuse of some K. I. Sawyer AFB properties may be restricted based on the investigation and subsequent remediation of SWMUs and AOCs that are determined to pose a threat to human health or the environment.

4.3.4.3 Installation Restoration Program. The IRP sites located within each land use area for the Recreation Alternative are identified in Figure 4.3-4 and summarized in Table 4.3-8. The continued IRP activities and the type of



EXPLANATION

①	Airfield *
②	Aviation Support *
③	Industrial
④	Institutional (Medical) *
⑤	Institutional (Educational)
⑥	Commercial
⑦	Residential
⑧	Public Facilities/ Recreation
⑨	Agriculture *
	IRP Site
	Benzene in Groundwater
	TCE in Groundwater
	Free Product Plume (JP-4)
	Ordnance Related Ranges
	TCE and PCE in Groundwater
	Base Boundary

0 950 1900 3800 Feet

Note: Plume boundaries not fully characterized.
* Standard land use designation not applicable to this figure.

IRP Sites and Related Groundwater Contamination; EOD Range, Grenade Ranges, and Small Arms Firing Range - Recreation Alternative

Figure 4.3-4

Table 4.3-8. IRP Sites within Land Use Areas - Recreation Alternative

Proposed Land Use	IRP Sites
Industrial	DP-01, DP-25, SS-05, SS-17, ST-04, ST-16, ST-21, ST-23, ST-24, Central Base TCE Plume, Central Base Benzene Plume, POL Area Benzene Plume, JP-4 Free Product Plume
Institutional (educational)	OT-15, ST-18, ST-22, Central Base TCE Plume, Central Base Benzene Plume, BX Service Station Benzene Plume
Commercial	None
Residential	Central Base TCE Plume
Public facilities/recreation	DP-02, DP-03, FT-06, FT-07, LF-08, LF-09, LF-10, LF-11, LF-12, OT-14, SS-17, ST-19, ST-20, Central Base TCE Plume, Central Base Benzene Plume, POL Area Benzene Plume, JP-4 Free Product Plume, BX Service Station Benzene Plume, Fire Training Area 1 TCE and PCE Plume, Fire Training Area 2 TCE and Benzene Plume

BX = Base Exchange
IRP = Installation Restoration Program
PCE = tetrachloroethane
POL = petroleum, oil, and lubricants
TCE = trichloroethylene

appropriate development for property adjacent to IRP sites would be similar to those discussed under the Proposed Action.

Industrial. Ongoing soil bioventing at Sites DP-01, SS-05, and ST-04, as well as continuing investigations at six additional IRP sites within the industrial land use zone, may delay property disposal by deed. Current remediation activities associated with the Central Base TCE Plume, as well as future monitoring and remediation of the Central Base Benzene, POL Area Benzene, and JP-4 Free Product plumes, could result in land use restrictions and delays in reuse. Impacts to industrial reuse are anticipated to be minor since only 5 percent of the proposed land use area is expected to be developed by 2015.

Institutional (Educational). Delays in property disposal by deed may occur as a result of remediation activities at Site ST-18. Land use restrictions as well as delays in disposal of property by deed could result from current groundwater monitoring programs and remediation activities associated with the Central Base TCE Plume and future implementation of remedial activities for the Central Base Benzene Plume and the Base Exchange Service Station Benzene Plume. Sites OT-15 and ST-22 have been approved for no further action; therefore, no impacts to reuse are anticipated at these sites.

Commercial. There are no IRP sites within the proposed commercial land use area.

Residential. Current and future remediation and groundwater monitoring activities associated with the Central Base TCE Plume may result in land use restrictions and delays in property disposal by deed.

Public Facilities/Recreation. Ongoing remediation at Sites DP-02, FT-06, and FT-07, as well as future remediation activities and long-term monitoring activities associated with seven additional sites and seven groundwater contamination plumes, could result in some delays in property disposal and reuse by deed as well as land use restrictions. However, based on the overall acreage and anticipated reuse associated with this land use, impacts due to IRP activities would be considered minor. Sites LF-12 and OT-14 have been approved for no further action, and Site DP-03 has been recommended for no further action; therefore, no impacts to reuse are anticipated at these sites.

4.3.4.4 Storage Tanks. Under the Recreation Alternative, industrial, institutional, and commercial facilities would require the use of both USTs and aboveground storage tanks. New and existing storage tanks required by the new owners/operators would be subject to the same federal, state, and local regulations as those discussed under the Proposed Action. Oil/water separators to be reused would be managed in accordance with applicable regulations.

Aboveground fuel storage tanks not utilized to support reuse activities would be emptied and purged of fumes to preclude fire hazards. Closure of USTs, aboveground storage tanks, and oil/water separators would be in accordance with applicable regulations similar to those discussed under the Proposed Action.

The hydrant fueling system would be closed in accordance with applicable regulations. Impacts associated with the closure of the hydrant fueling system would be similar to those discussed under the Proposed Action.

4.3.4.5 Asbestos. Renovation and demolition of existing structures that contain ACM may occur with reuse development under the Recreation Alternative. Scheduled demolition and renovation would be considerably greater than such activities identified under the Proposed Action and other alternatives. These activities are subject to all applicable federal, state, and local regulations to minimize the potential risk to human health and the environment; therefore, no impacts would occur as a result of the Recreation Alternative. Property recipients would be advised, to the extent known, of the type, condition, and amount of ACM within any real property conveyed.

4.3.4.6 Pesticides. Pesticide usage would increase over closure baseline conditions under the Recreation Alternative due to an increase in industrial, institutional (educational), commercial, residential, and public facilities/

recreation land use areas. Pesticide use under this alternative would be considerably less than under the Proposed Action and the other alternatives because of a decrease in developed/landscaped areas and residential use. Management practices would be subject to FIFRA and state guidelines and would preclude any unacceptable impacts.

4.3.4.7 Polychlorinated Biphenyls. All federally and state-regulated PCB equipment and PCB-contaminated equipment have been removed and properly disposed of; therefore, no impacts would occur.

4.3.4.8 Radon. Since all radon screening survey results were below U.S. EPA's recommended mitigation level of 4 pCi/l, there would be no impacts on reuse activities.

4.3.4.9 Medical/Biohazardous Waste. No medical/biohazardous waste would be generated under the Recreation Alternative. Therefore, no impacts from medical/biohazardous wastes would result.

4.3.4.10 Ordnance. Management of the EOD range, the active and former grenade ranges, the small arms firing range, and former skeet range would be similar to those practices discussed under the Proposed Action. There would be no reuse of the small arms firing range under this alternative.

4.3.4.11 Lead-Based Paint. Lead-based paint management practices under this alternative would be similar to those identified under the Proposed Action.

4.3.4.12 Mitigation Measures. Measures for this alternative would be similar to those identified under the Proposed Action.

4.3.5 No-Action Alternative

Facility and grounds maintenance (e.g., painting and pest control) would be the primary activities that would involve hazardous materials. Under the No-Action Alternative, the OL and caretaker would manage all hazardous waste under the applicable regulations. The only other hazardous materials/waste issues associated with this alternative would concern the final phases of the IRP activities.

4.3.5.1 Hazardous Materials Management. Hazardous materials would be used in preventive and regular maintenance activities, grounds maintenance, and water and wastewater treatment. The materials used for these activities would include heating oils, motor fuels, POL, pesticides, paints, and thinners. The OL and caretaker would be responsible for hazardous materials handling training, as well as hazardous materials communication requirements of the EPCRA and OSHA regulations. Quantities of hazardous materials would be similar to those used at closure.

4.3.5.2 Hazardous Waste Management. With the exception of facilities used by OL and caretaker personnel, all accumulation points and satellite accumulation points would be closed, and the DRMO would dispose of all hazardous waste prior to closure. The amount of hazardous waste generated would be similar to the amount generated at closure. The small amount of hazardous waste that would be generated under the No-Action Alternative may enable the OL and caretaker to become an exempt, small-quantity generator. The OL and caretaker must comply with all applicable RCRA and state hazardous waste regulations. Additionally, SWMUs and AOCs determined to pose a threat to human health or the environment would be remediated.

4.3.5.3 Installation Restoration Program. Ongoing investigations and remedial design activities would be continued by the individual IRP contractors. The OL would support the utility requirements for these contractors and provide security for the IRP areas.

The groundwater pump-and-treat system will continue to remediate the Central Base TCE Plume (including Site DP-02). The remaining groundwater contamination plumes will undergo an RI/FS to determine the extent of contamination and evaluate remediation alternatives with the exception of the Fire Training Area 2 TCE and Benzene Plume which is scheduled for continued monitoring only. All base landfill sites, except Site LF-12, are undergoing similar RI/FS investigations. A site(s) remediation plan will be submitted for regulatory approval and public review, with a final decision on remediation presented in a ROD. Upon issuing a ROD, design and eventual implementation of a remediation alternative may begin. Soil bioventing systems in place at the POL Storage Area (OU-1; Sites DP-01, SS-05, and ST-04) and the Fire Training Areas (Sites FT-06 and FT-07) will remain in operation; however, final remediation methods have yet to be determined. Investigations to determine the existence of any additional petroleum-contaminated soils will continue at the sites identified during the 1992 basewide UST removal project. Sites LF-12, OT-14, OT-15, and ST-22 have been approved, and Site DP-03 has been recommended for no further action. No additional investigation of these sites will be conducted.

4.3.5.4 Storage Tanks. USTs remaining at K. I. Sawyer AFB would be managed by the OL and caretaker. Cathodic protection and leak detection systems on the USTs would be the responsibility of the OL and caretaker. Federal regulations require the closure of USTs out of service for 1 year or longer. The apron hydrant fueling system is scheduled to be closed in place in accordance with all applicable regulations.

The aboveground storage tanks would be purged of fuel fumes to preclude fire hazards. MDNR may order the removal of tanks that are out of service. The OL and caretaker would provide repair and general maintenance for the

remaining aboveground storage tanks and piping. Under the No-Action Alternative, all oil/water separators would be pumped and cleaned.

4.3.5.5 Asbestos. The impacts from ACM under the No-Action Alternative would be minimal. Vacated buildings would be secured to prevent contact with ACM if the No-Action Alternative were implemented. Management of ACM in occupied facilities would be accomplished to protect human health.

4.3.5.6 Pesticides. Under the No-Action Alternative, the grounds and golf course would be maintained in a manner to facilitate economic resumption of use. There should not be an appreciable increase in the use of pesticides from the closure baseline. Application of pesticides would be conducted in accordance with FIFRA and state regulations to ensure the proper and safe handling and application of all chemicals.

4.3.5.7 Polychlorinated Biphenyls. All federally and state-regulated PCB equipment and PCB-contaminated equipment has been removed and properly disposed of; therefore, these materials will not create any impacts under the No-Action Alternative.

4.3.5.8 Radon. Since all radon screening survey results were below U.S. EPA's recommended mitigation level of 4 pCi/l, there would be no impact from implementation of the No-Action Alternative.

4.3.5.9 Medical/Biohazardous Waste. All existing materials will be removed prior to closure; therefore, these materials would not create an impact under the No-Action Alternative.

4.3.5.10 Ordnance. The EOD range and the active and former grenade ranges will be cleared of unexploded ordnance; the small arms firing range will be cleared of spent bullets. All facilities, including the former skeet range, will be investigated to determine the presence of soil contamination, and any contaminated soils would be remediated.

4.3.5.11 Lead-Based Paint. Impacts from lead-based paint under the No-Action Alternative would be minimal. Vacated facilities would be secured to prevent entry. Occupied facilities would be maintained to prevent exposure to lead-based paint.

4.3.5.12 Mitigation Measures. Under the No-Action Alternative, the OL and caretaker would be responsible for the basewide management of hazardous materials/waste. Contingency plans developed to address spill response would be less extensive than those required for any of the reuse alternatives. Implementation of such procedures could effectively mitigate any potential impacts associated with the No-Action Alternative.

4.3.6 Other Land Use Concepts

This section discusses the independent land use concepts within the framework of the IRP, and within the context of the hazardous materials typically associated with the proposed reuse.

Michigan Army National Guard. Vehicle maintenance operations at Building 608 would utilize hazardous materials such as motor fuels, POL, hydraulic fluids, corrosives, paints, thinners, solvents, cleaners, and ignitables. Hazardous wastes would be generated from the use of these materials. Household cleaning products, paints, and thinners would be utilized at the crew readiness facility (Building 104). All hazardous materials and waste management would be handled in accordance with applicable regulations. Seven SWMUs (26, 78, 79, 80, 81, 92, and 96) have been identified at Building 608; descriptions of these SWMUs are provided in Appendix G. Only SWMU 26, the Basewide Sanitary Sewer System, is associated with Building 104. Investigations and any necessary remediation of SWMUs could impact the reuse of these facilities. There are no IRP sites within this land use concept. Use of the small arms firing range by the MANG would be in accordance with applicable regulations. Buildings 104, 608, and 5023, as well as the small arms firing range support facility (Building 866), have not been surveyed for ACM and may also contain lead-based paint since all of these facilities were constructed prior to 1978. If ACM or lead-based paint are discovered in these facilities and they pose a risk to human health or the environment, they would be abated in accordance with applicable regulations. If pesticides are used under this concept, they would be managed in accordance with FIFRA.

No impacts relating to hazardous materials and hazardous waste management have been identified for the driving skills practice area in the west-central portion of the base.

Correctional Institution. Hazardous materials would be utilized for facility maintenance and operations. These materials would include fuels, POL, heating oils, paints, thinners, solvents, pesticides, and household products. Small amounts of hazardous wastes may be generated by the use of hazardous materials. In addition, small amounts of biomedical wastes may be generated; these wastes would be handled in accordance with applicable federal and state regulations. Installation of new storage tanks would comply with federal and state standards. Management of this facility in compliance with all applicable regulations would preclude any unacceptable impacts. No IRP sites have been identified within the proposed correctional facility land use area.

Sawmill. Hazardous materials would be used for sawmill equipment and vehicle maintenance, and would most likely include motor fuels, POL, hydraulic fluids, antifreeze, solvents, degreasers, paints, thinners, pesticides,

wood preservatives, and, to a lesser extent, hazardous household and office products. The use of these materials may generate small amounts of hazardous waste. Reuse of some facilities may be delayed, or restrictions may be imposed on certain areas associated with this alternative as a result of ongoing investigations and/or subsequent remediation of ten SWMUs and two AOCs. The SWMUs and AOCs associated with this alternative include the basewide SWMUs 26 and 27 (the sanitary sewer and storm drain systems) in addition to SWMUs 74, 75, 85, 86, 87, 92, 95, and 99, and AOCs H and J. No IRP sites are associated with this proposed reuse. Installation and management of new storage tanks would be conducted in accordance with federal and state regulations. If ACM or lead-based paint are identified in any facility associated with this proposed reuse, and if they pose a risk to human health or the environment, they will be abated in accordance with applicable regulations. Any pesticides utilized under this proposal would be managed in accordance with FIFRA.

Waste to Energy/Recycling. Hazardous materials most likely to be utilized under this land use concept could include motor fuels, POL, hydraulic fluids, antifreeze, solvents, and degreasers for vehicle maintenance. Facility maintenance could include the use of hazardous materials such as heating fuels, POL, pesticides, paints, thinners, and household products. The use of these materials may generate small amounts of hazardous wastes. Operations conducted with this proposed reuse would also include the transport and storage on base of hazardous waste found during the recycling of solid waste. These wastes would be stored in accordance with applicable regulations and would be disposed of in an off-base-regulated facility. Delays in facility reuse or restrictions on land use may result from the investigation and/or remediation of ten SWMUs and one AOC associated with the heat plant (SWMUs 18, 19, 20, 21, 22, 23, 24, 25, 26 [sanitary sewer system], 27 [storm drain system], and AOC 105 [the heating plant coal storage pile]). SWMUs 2 and 3 are associated with the DRMO facility (Buildings 417 and 419, respectively). Similar impacts to reuse may result from investigation and/or remediation associated with IRP Site SS-05 (DRMO Storage Yard). Installation and management of new storage tanks would be conducted in accordance with federal and state regulations. Asbestos and/or lead-based paint that poses a risk to human health or the environment, identified in any facility associated with this proposed reuse would be abated in accordance with applicable regulations. The use of pesticides under this proposed reuse would be conducted in accordance with FIFRA.

Waste to Energy/Environmental Support Operations. Hazardous materials most likely to be utilized under this proposed reuse could include motor fuels, POL, hydraulic fluids, antifreeze, solvents, and degreasers for vehicle maintenance. Facility maintenance could include the use of hazardous materials such as heating fuels, POL, pesticides, paints, thinners, and household products. The use of these materials may generate small

amounts of hazardous waste. Operations conducted in accordance with this proposed reuse would also include the transport and storage of hazardous waste on base. Waste would be stored in accordance with applicable regulations and would be disposed of in an off-base-regulated facility. Delays in facility reuse or restrictions on land use may result from the investigation and/or remediation of SWMUs and one AOC associated with the facilities proposed for reuse under this land use concept. SWMUs 26 (sanitary sewer system) and 27 (storm drain system) are basewide and are associated with all of the facilities considered here. In addition, there are eight SWMUs and one AOC at the heating plant (SWMUs 18, 19, 20, 21, 22, 23, 24, 25, and AOC 105). SWMUs 68, 69, 70, and 71 are associated with the auto hobby shop (Building 824) and SWMU 73 is at the Base Exchange service station (Building 826). There are no other SWMUs or AOCs associated with the Education Center (Building 540) or the Base Exchange (Building 643). Impacts to reuse may result from investigation and/or remediation associated with IRP sites ST-18 and ST-22. Additionally, land use restrictions may be implemented in the area of the Base Exchange service station in order to accommodate remediation of the benzene groundwater plume. Installation and management of new storage tanks would be conducted in accordance with federal and state regulation. Asbestos and/or lead-based paint that poses a risk to human health or the environment and identified in any facility associated with this proposed reuse would be abated in accordance with applicable regulations. The use of pesticides under this proposed reuse shall be conducted in accordance with FIFRA.

4.4 NATURAL ENVIRONMENT

This section describes the potential environmental effects of the reuse alternatives on the natural resources of geology and soils, water resources, air quality, noise, biological resources, and cultural resources on the base and in the surrounding region.

4.4.1 Geology and Soils

The potential environmental effects of the Proposed Action and reuse alternatives on the local geology and soils have been analyzed based on review of published literature. Geology and soils would be affected primarily during ground-disturbing activities, where local soil profiles could be altered. Most of the soil impacts would be short term; disturbed soils would remain relatively stable in the long term because they would be overlain by facilities or pavement, or managed in accordance with the Natural Resources Conservation Service recommendations to minimize erosion. Acreages to be disturbed under the Proposed Action and alternatives between closure and 5, 10, and 20 years of redevelopment are presented in Chapter 2. Soil contamination from hazardous materials/wastes is discussed in Section 4.3, Hazardous Materials and Hazardous Waste Management.

4.4.1.1 Proposed Action. Effects of the Proposed Action on the regional geology and soils would be minimal, and would result primarily from ground disturbance associated with facility construction, renovation, demolition, and infrastructure improvement. These activities could alter the soil profiles and local topography.

Use of sand and gravel resources (e.g., for construction material and concrete) for new facilities and roadways would not be expected to reduce availability of these materials from local supplies. No sand and gravel deposits of economic interest are known or expected to be present at K. I. Sawyer AFB.

The Proposed Action is not expected to cause any impacts to potential mineral resources. The proposed reuse activities are similar to existing base operations; therefore, conditions regarding mineral resources are not expected to change. These actions would not cause any irreversible or irretrievable loss of resources.

Under the Proposed Action, 681 acres of land would be disturbed. Because local soils are susceptible to wind erosion, short-term impacts could occur. During ground-disturbing activities, demolition of existing facilities, removal of vegetative cover, and grading would increase the potential for wind erosion. With the Proposed Action most of the erosion potential would be associated with the development of the industrial area within the military family housing area and areas west of the runway. Prior to construction a soil erosion control plan for disturbances greater than 1 acre would need to be prepared and submitted to the county for approval as part of the construction permitting process. This plan must include a detailed strategy for reduction of potential soil erosion. Once disturbed areas have been covered with pavement, buildings, facilities, or vegetation, susceptibility to erosion would be minimal.

Military activities associated with the MANG and U.S. Army Reserve would consist of equipment and operations training and temporary channel bridge assembly. Because no soil disturbance other than off-road driving is anticipated, impacts are expected to be minimal.

The organic soil of the Silver Lead Creek area severely limits its suitability for building development. The Proposed Action does not include plans to develop the Silver Lead Creek area. Conversely, the upland area soils on base are well suited for roadway and facility development.

A Farmland Conversion Impact Rating Form (AD-1006) was prepared and submitted to the Natural Resources Conservation Service to evaluate impacts to prime farmland soils. The Natural Resources Conservation Service determined that no prime, unique, statewide, or local important farmland would be affected (Appendix L).

As discussed in Section 4.3, Hazardous Materials and Hazardous Waste Management, ongoing studies and restorations of contaminated soil would continue as required. Because the specific decisions within the Proposed Action would be designed to prevent interference with these activities, no impacts to soil contamination would be expected.

Mitigation Measures. A soil erosion control plan for disturbances greater than 1 acre would be required by the Marquette County Health Department to reduce erosion associated with the ground disturbance anticipated under this alternative. Various alternative measures are available to minimize erosion problems associated with wind and water, especially during ground-disturbing activities when trenches and cut slopes are exposed. The Guidebook for Best Management Practices for Michigan Watersheds (Michigan Department of Natural Resources, n.d.) prepared by the MDNR Surface Water Quality Division provides methods for controlling erosion from construction sites and other areas. In addition, the Marquette County Soil and Water Conservation District has prepared the Uniform Standards and Specifications for Michigan's Soil Erosion and Sedimentation Control Act for Marquette County to establish basic criteria for design, installation, and maintenance of soil erosion and sediment control in the county. The following is an example of some of the various recommendations contained within these documents that could be used to reduce soil erosion:

- Addition of protective covering, such as mulch, straw, plastic, netting over the mulch or straw, or combinations of the above

- Use of sandbags as diverting techniques or sediment basins to reduce water erosion of slopes, partial graded streets, and graded building pads

- Maintenance of a buffer strip of vegetation around streams or lakes, where possible, to filter sediments

- Revegetation of slopes and open areas as soon as practical with seeded wood-base mulch

- Limiting the amount of area disturbed and the length of time slopes and barren ground are exposed

- Retaining as much tree cover adjacent to exposed ground as possible for use as natural wind breaks.

After the construction phase, the most effective long-term erosion control could be accomplished by keeping soils under vegetation cover and planting wind breaks. The type of vegetation used as wind breaks must comply with FAA standards in areas intended for aircraft runways and taxiways. After construction, soils underlying facilities and pavements would not be subject to erosion. Soil erosion measures would be implemented by the property

recipients or their development contractor. The effectiveness and cost of the above mitigation measures would depend upon the wind, soil type, slope, and type of material used to reduce erosion. The above measures for reducing soil erosion are all considered effective depending on the site characteristics. For construction near housing or streams the most effective measures to reduce soil erosion effects may include the use of buffer strips. Buffer strips could consist of natural vegetation, undeveloped land, or may be planted with grasses such as red fescue or perennial rye grass. For steep slopes or partially graded areas the use of sandbags or sediment basins has been proven effective in reducing erosion. Effective measures for reducing soil erosion on level areas not near critical resources could include limiting the amount of area disturbed and length of time the barren area is exposed. Reducing soil erosion would benefit water resources and biological resources by minimizing turbidity in streams and wetlands.

4.4.1.2 International Wayport Alternative. Effects of the International Wayport Alternative on the regional geology and soils would be similar to those under the Proposed Action, except less land (380 acres) would be disturbed. Effects from soil disturbance and erosion are considered to be short term because exposed areas would be covered by pavement or natural landscaping, thus reducing the erosion potential. Timber activities within the agricultural land use would occur once during the 20-year analysis period. Because of the permeable soils, flat topography of this area, and reforestation after harvesting, effects of erosion would be minimal. Construction of the crosswind runway proposed for this alternative would not be expected to reduce availability of local sand and gravel resources.

Mitigation Measures. Potential mitigation measures to minimize erosion would be similar to those discussed for the Proposed Action. Potential erosion resulting from forest management activities could be reduced by the property recipients by limiting the time between harvest and reforestation. Additionally, limiting individual harvest areas has been found effective in reducing erosion. This can be accomplished by dispersing small patch cuts over a large area and not allowing harvest of adjacent areas until new stands have become established. Following the recommendations of the Escanaba River State Forest Comprehensive Resource Management Plan during timber harvesting would further reduce soil erosion. Recommendations in the plan that have been found most effective in reducing the effects of soil erosion to water bodies include maintaining a band of natural vegetation, 150 feet wide, on each side of and parallel to the water resource (Michigan Department of Natural Resources, 1991). Reducing soil erosion from timber activities would benefit water resources and biological resources by minimizing turbidity in streams and wetlands.

4.4.1.3 Commercial Aviation Alternative. Types of impacts associated with geology and soils under this alternative would be similar to those under the Proposed Action, except that less land (259 acres) would be disturbed.

Impacts from soil disturbance and erosion are considered to be short term because exposed areas would be covered by pavement or natural landscaping, thus reducing the erosion potential. There would be some potential for increased erosion of soil by wind and water in the military family housing area, which is proposed for demolition, until vegetation becomes re-established. Timber activities within the agricultural land use would occur once during the 20-year analysis period. Because of the permeable soils and flat topography, effects of erosion would be minimal.

Mitigation Measures. Potential mitigation measures to minimize erosion would be similar to those discussed for the Proposed Action. Mitigation measures for timber harvesting would be the same as those discussed for the International Wayport Alternative.

4.4.1.4 Recreation Alternative. Types of impacts associated with geology and soils under this alternative would be similar to those under the Proposed Action, except that less land (201 acres) would be disturbed. Exposure of those soils caused by the demolition of more than two-thirds of the military family housing would increase the potential for erosion, but this impact would be short term until vegetation is re-established.

Mitigation Measures. Potential mitigation measures to minimize erosion would be similar to those discussed for the Proposed Action.

4.4.1.5 No-Action Alternative. The No-Action Alternative would result in no impacts to the geology and soils of the base area or the surrounding region. The construction activities associated with this alternative would be minimal or nonexistent and would be restricted to maintenance activities. Therefore, no mitigation measures would be required.

4.4.1.6 Other Land Use Concepts. Effects on geology and soils as a result of the other land use concepts that may be implemented are described below.

Michigan Army National Guard. Training maneuvers associated with this use could impact soils through erosion if vehicles (e.g., bulldozers) are used off road. MANG does not propose using these vehicles to move soil, but only to practice driving skills; therefore, soil disturbance is expected to be minimal. No impacts would be associated with vehicle maintenance activities in Building 608.

Correctional Institution. Building this proposed facility could disturb up to 161 acres. Construction and grading activities associated with the correctional institution would increase the potential for erosion effects, similar to those under the reuse alternatives. However, mitigation measures, as described under the Proposed Action, would be implemented during construction to limit the amount of soil erosion.

Sawmill. Proposed construction under this land use concept could disturb up to 2 acres. Construction and grading activities associated with the sawmill would increase the potential for erosion effects, similar to those under the reuse alternatives. However, mitigation measures, as described under the Proposed Action, would be implemented during construction to limit the amount of soil erosion.

Waste to Energy/Recycling. No construction or operational activities that would disturb the geology and soils on the base would occur under this concept.

Waste to Energy/Environmental Support Operations. The minor construction associated with this concept would be less than 1 acre. Proposed construction would occur within the heating plant facility and would not affect local geology and soils.

4.4.2 Water Resources

The following section describes the potential environmental effects on water resources as a result of the Proposed Action and alternatives. Ground-disturbing activities could alter soil profiles and natural drainages, which, in turn, could alter water flow patterns temporarily. Impacts on water quality from hazardous waste contamination are addressed in Section 4.3, Hazardous Materials and Hazardous Waste Management.

4.4.2.1 Proposed Action

Surface Water. Under the Proposed Action, soils would be compacted during facility construction, renovation, and demolition, as well as infrastructure improvements, and overlain by asphalt, asphaltic concrete, or buildings, creating impervious surfaces that would cause increased storm water runoff to local storm sewers and sewage systems. As a result, drainage patterns would be altered to divert water away from facilities and airfield pavements. Storm water discharge (non-point source) from the airfield, aviation support areas, and other industrial areas may contain fuels, oils, and other residual contaminants which could degrade surface water resources in Silver Lead Creek, Big Creek, and Escanaba River. The runoff from demolition of the military family housing for the proposed industrial area in the eastern portion of the base could potentially degrade water quality in Silver Lead Creek and areas immediately east of the base until facilities or landscaping are established. Military activities of the MANG and U.S. Army Reserve are expected to create minimal ground disturbance; therefore, effects to water resources would be negligible.

It is assumed that ground-disturbing activities (see Table 2.2-3) under the Proposed Action would occur in areas historically subject to development (i.e., central and southwest portions of the base) except for the areas west

of the runway. As a result, minimal or no ground disturbance would occur in the floodplains that are likely to occur along or near Silver Lead Creek (see Figure 3.4-2). Therefore, minimal impacts to these potential floodplains would be expected. The establishment of these areas as recreation areas could indirectly cause beneficial impacts, in that these uses would preserve the floodplains and prevent future development.

To ensure minimal potential for future impacts to probable floodplains, the Air Force would comply with appropriate requirements for disposal of property in floodplains on Air Force fee-owned land, as established in Executive Order 11988 and AF 132-7060. Property transferred to other federal agencies (e.g., the DOI property) would continue to be subject to these requirements; disposal of Air Force property to non-federal agencies or private entities would require full disclosure of federal, state, and local restrictions on use of the floodplains.

The project would also be subject to NPDES permit requirements for storm water discharges during the construction period and for the duration of operation. This provision is contained in the NPDES permit Application Regulations for Storm Water Discharge issued by the U.S. EPA as a final rule on November 16, 1990. Oil/water separators could be installed to improve water quality prior to discharge to a storm water drainage system.

Groundwater. Under the Proposed Action, there would be minimal adverse impacts to groundwater resources. In 2015, on-site demand is expected to be 2.4 MGD, which is approximately 240 percent of the preclosure (1992) base demand. The current production capacity of the on-base wells is 3.0 MGD, which would be adequate to meet the anticipated demands of reuse. However, if the migration of contaminated groundwater plumes results in the closure of the on-base wells, an alternate supply source (e.g., Lake Superior) would have to be developed.

Water supply wells on K. I. Sawyer AFB may continue to be used in the short term under the Proposed Action. Because known groundwater contamination on K. I. Sawyer AFB is being investigated under the IRP (see Section 4.3), careful monitoring of water quality conditions at these wells would be appropriate. Also, these wells would become subject to local ordinances and may need to be considered in terms of the state wellhead protection program; these factors may restrict future development activities adjacent to the wells.

Local groundwater supplies underlying K. I. Sawyer AFB east of Silver Lead Creek were being investigated by the USGS to determine the cause of falling lake levels southeast of the base; results of the study were inconclusive and could not determine if the cause was from increased groundwater withdrawal or drought conditions. Because the results of the study were inconclusive, the increase in on-base water consumption over preclosure

demand under the Proposed Action could exacerbate the lowering lake level condition. However, the following could be implemented by the reuser which may reduce effects on the lakes: (1) reduce the yield of water from the wells to a level that would prevent lowering of the water at nearby lakes; or (2) close the wells and develop an alternate water supply from new wells utilizing a different aquifer.

As discussed in Section 4.3, Hazardous Materials and Hazardous Waste Management, ongoing studies and restoration of contaminated groundwater would continue as required; specific decisions within this alternative would be designed to prevent interference with these activities. No impacts to remediation of water contamination would be expected.

Mitigation Measures. Mitigation measures to reduce impacts from surface water runoff would be similar to those discussed for soil erosion (Section 4.4.1.1); and primarily apply to construction-related activities. The following practices could be implemented by the property recipients or their development contractor to reduce the impacts to surface water quality:

- Follow recommendations of the Bi-National Program to Restore and Protect the Lake Superior Basin for reducing toxic discharge.

- Create landscaped areas that are pervious to surface water.

- Minimize areas of surface disturbance.

- Minimize time that disturbed areas are exposed to erosion.

The effectiveness and cost of these mitigation measures would be based on the amount and distribution of site development, characteristics of existing surface water runoff adjacent to the site, and the combination of specific mitigations used. Following the recommendations of the Bi-National Program to restore and protect the Lake Superior Basin would be effective in reducing toxic discharge. The effectiveness of minimizing area and time of disturbance would be approximately proportional to the amount minimized. Protective covering would be effective during construction activities. The use of grasses, such as red fescue and perennial rye grass, to stabilize soils and reduce runoff would be effective in the long term, but would be more costly and less effective than protective covering in the short term.

Implementation of a wellhead protection program for the base wells would reduce the possibility of future impact to water supply. Because it is possible that the on-base wells are the cause of falling lake levels west of the base, the property recipient could reduce the amount of water pumped from the wells or locate an alternative water supply to minimize the potential impacts to the lakes. If possible, reducing the yields of the water wells

would be the most cost-effective mitigation and would have the fewest environmental effects.

4.4.2.2 International Wayport Alternative

Surface Water. The types of impacts associated with water resources under this alternative would be similar to those under the Proposed Action. No major changes to drainages would result from reuse construction. New NPDES permits may be required for construction and operation activities. Timber activities, which would occur once during the 20-year analysis period, could affect the surface waters of the Big Creek drainage until the area is reforested.

Groundwater. Under the International Wayport Alternative, there would be minimal adverse impacts to groundwater resources. In 2015, on-site demand would be 0.9 MGD, which is approximately 90 percent of the preclosure (1992) base demand. The current production capacity of the on-base wells is 3.0 MGD, which would be adequate to meet the anticipated demands of reuse. Local groundwater supplies would be sufficient to meet projected water demands for this alternative. On-base wells No. 9 and No. 10 may be the cause of falling lake levels east of the base; reduced water requirements under this alternative compared to preclosure conditions would not exacerbate this condition. However, as discussed under the Proposed Action, measures such as reducing yields or finding alternate water supplies could be implemented. Other effects on groundwater would be similar to those described for the Proposed Action.

Mitigation Measures. Potential mitigation measures would be similar to those discussed for the Proposed Action. Mitigation measures for timber activities along the Big Creek drainage could include maintaining buffer zones or uncut areas along the banks as described under Section 4.4.1.1.

4.4.2.3 Commercial Aviation Alternative

Surface Water. Impacts to surface water resources under this alternative would be similar to those under the Proposed Action. The runoff from the demolition of residential units in the eastern portion of the base and timber harvesting in the northern portion of the base could potentially degrade water quality in Big Creek until vegetation is re-established.

Groundwater. This alternative would generate less demand for water supply than the Proposed Action. By 2015, on-site water demand would be 0.7 MGD, which is 70 percent of the 1992 base demand. This projected demand could be met by the capacities of the existing on-base wells. Local groundwater supplies would be sufficient to meet projected demands. Effects on falling lake levels east of the base would be the same as

described for the International Wayport Alternative. Other effects on groundwater would be similar to those described for the Proposed Action.

Mitigation Measures. Potential mitigation measures would be similar to those discussed for the Proposed Action. Mitigation measures for timber activities along the Big Creek drainage could include maintaining buffer zones or uncut areas along the banks as discussed in Section 4.4.1.1.

4.4.2.4 Recreation Alternative

Surface Water. The types of impacts to surface water resources under this alternative would be similar to those under the Proposed Action for storm water discharge from industrial areas. Under this alternative the limited amount of development would preclude large amounts of storm water runoff that may contain contaminants. The runoff from the demolition of residential units in the eastern portion of the base could potentially degrade water quality until vegetation is re-established.

Groundwater. The quantity of groundwater extracted under this alternative would be significantly less than that required for the Proposed Action. By 2015, on-site water demand would be 0.2 MGD, which is 20 percent of the 1992 base demand. This projected demand could be met by the capacities of the existing on-base wells. Local groundwater supplies would be sufficient to meet projected demands. Effects on falling lake levels east of the base would be the same as described for the International Wayport Alternative. Other effects on groundwater would be similar to the Proposed Action.

Mitigation Measures. Potential mitigation measures would be similar to those discussed for the Proposed Action.

4.4.2.5 No-Action Alternative. The No-Action Alternative would have beneficial effects on surface and groundwater quality because there would be very limited operations and no increase in population. Water demands for OL personnel and activities would be minimal and could be met by existing supply systems. No mitigation measures would be required.

4.4.2.6 Other Land Use Concepts. Effects on water resources as a result of the other land use concepts that may be implemented are described below. All of the activities would be subject to NPDES permit requirements as described under the Proposed Action.

Michigan Army National Guard. Implementation of this land use concept would not create any additional impacts on water demand because it would create a minimal increase in consumption, which could be met by existing supplies. Because only small increases in sediment loading from erosion are expected, effects to water resources would be minimal. Potential impacts to

wetlands within this land use concept are addressed under Section 4.4.5, Biological Resources.

Correctional Institution. Runoff during construction would slightly increase impacts to surface and groundwater resources, similar to the reuse alternatives. Mitigation measures, as described for the Proposed Action, would be implemented to minimize these impacts. During the operations phase, the facility's projected water consumption would be 0.35 MGD. When combined with the reuse alternatives, water supply requirements would be met by local groundwater supplies; there would be no impacts to water resources.

Sawmill. Implementation of this land use concept would not create any additional impacts on water demand because its minimal increase in consumption could be met by existing supplies. Runoff during construction would slightly increase impacts to surface and groundwater resources, similar to the reuse alternatives. Mitigation measures, as described for the Proposed Action, would be implemented to minimize these impacts. Impacts from the operation of the boiler would be minimal because the water would be recycled through the system. Potential impacts to wetlands within this land use concept are addressed in Section 4.4.5, Biological Resources.

Waste to Energy/Recycling. Implementation of this land use concept would not create any additional impacts on water demand. No ground disturbance is anticipated with this concept, and wastewater from operations would be directed to the sanitary sewer system after going through an oil/water separator. Municipal solid waste for this concept would be processed in a covered facility, reducing the potential for storm water runoff from the recycling area.

Waste to Energy/Environmental Support Operations. Implementation of this land use concept would increase water consumption in conjunction with the Proposed Action and alternatives. The water consumption would be within the capacity of the base water system; however, to reduce potable water use, up to 0.47 MGD of reclaimed water from the base WWTP for operations could be used for the incineration process. A small amount of ground disturbance may occur within the heating plant facility, but effects to water resources would be minimal. Municipal solid waste would be processed in a covered facility, reducing the potential for storm water runoff from the heating plant area. Other than domestic sanitary waste, no other wastewater would be produced from plant operations. Domestic sanitary waste from septic tanks and leachate collected from the Marquette County Landfill as part of this concept would be processed through the WWTP. The leachate collection and processing through the WWTP would be similar to the process conducted at the base prior to closure.

4.4.3 Air Quality

Air quality impacts would occur during construction and operations associated with the Proposed Action and alternatives for K. I. Sawyer AFB. Intermittent construction-related impacts would result from fugitive dust (particulate matter) and construction equipment emissions. Operational impacts would occur from (1) mobile sources such as aircraft, aircraft operation support equipment, and automobiles; (2) point sources such as heating/power plants, generators, incinerators, and storage tanks; and (3) secondary emission sources associated with population increase, such as residential heating.

The methods selected to analyze impacts depend upon the type of emission source being examined. Air quality analytical methods are summarized here and presented in detail in Appendix I. Analysis of air quality impacts during the construction activities consisted of estimating the amount of uncontrolled fugitive dust emitted from disturbed areas and the combustion emissions associated with construction equipment. Analysis of air quality impacts for the operational activities involved calculating the emissions from aircraft, vehicle trips, and other sources associated with the alternatives. The sum of construction and aircraft, vehicle trips, and other source emissions was then compared to preclosure conditions to determine if the Proposed Action or alternatives would affect the region's ability to maintain the NAAQS.

Ambient effects on local air quality are analyzed by modeling pollutant concentrations at receptor locations likely to receive maximum air quality impacts. For aviation-related alternatives, maximum impact is associated with aircraft operations. A number of receptors are therefore typically selected at the downwind end of the runway for modeling purposes. Other non-aviation activities on base would not significantly contribute to the air quality impacts at those receptor locations.

The ambient effects of aircraft are analyzed by modeling with the EDMS (Segal, 1988a, 1988b, and 1991). EDMS was developed jointly by the FAA and the U.S. Air Force specifically for the purpose of generating airport and air base emissions inventories and for calculating the ambient concentrations caused by these emissions as they disperse downwind. The EDMS model uses U.S. EPA and U.S. military aircraft emission factors and information on peak and annual landing and takeoff cycles to produce an emissions inventory of aircraft operations. Typical aircraft operations include takeoff and landing, runway climb and approach, touch and go, runway queuing, taxi-in and taxi-out, and idling at the gates.

Air quality modeling is presented for the Proposed Action and alternatives through 2005 (10 years after closure). The effects of the 1990 CAA Amendments, such as electric and other low-emission vehicle ownership

percentages, cannot be accurately predicted very far into the twenty-first century. The uncertainties of long-range population and traffic projections, future CAA changes, and the complex interaction of meteorology with emission inventories make emission and pollution concentration projections beyond 10 years too speculative.

The following assumptions were made in estimating the effects of the Proposed Action and alternatives:

- For construction, fugitive dust emissions were based on the acreage disturbed each year. Grading activity was assumed to occur 115 days per year. Construction equipment was assumed to be active 230 days per year.

- EDMS was used to calculate annual aircraft emissions for airport operations.

- MOBILE 5.0A was used to generate emission factors for on-road vehicles. U.S. EPA-recommended default values were used whenever possible. It was assumed that the average one-way vehicle trip for each alternative was 15 miles.

It was assumed that reuse-related point and area source emissions (with the exception of those occurring for the Proposed Action heavy industrial land use area) would be less than preclosure point and area source emissions.

- The Base Realignment and Closure Air Emission Factor Calculator, developed to support air emission calculations for base realignment and closure activities, was used to calculate per-employee emission factors typical of industry in the state of Michigan. The Base Realignment and Closure Air Emission Factor Calculator includes emissions inventory data from the 1990 Aerometric Information Retrieval System and area and off-road mobile source information from the 1990 Interim Inventory section of EGADS. The per-employee emission factors were assumed to be representative of factors that would be associated with the heavy industrial land use area of the Proposed Action.

New or modified major sources of NO_2, CO, and/or SO_2 in an attainment area must not cause or contribute to an exceedance of an ambient air quality standard. Except for CO, the PSD program prevents emissions of pollutants in an attainment area from creating a nonattainment condition by limiting the allowable ambient impact of NO_2, PM_{10}, and SO_2 emissions from new or modified major stationary sources to specific increments (see Table 3.4-3). These increments are designed to prevent new or modified sources from causing significant degradation of an area's air quality. For PSD purposes, major stationary sources are generally defined as those that emit more than 100 tons per year of an attainment pollutant. Ambient impacts from new or

modified air pollution sources are generally determined through air quality modeling. While the PSD process provides adequate means for assessing and regulating impacts from stationary sources of air pollution, this process does not provide a mechanism for dealing with non-stationary sources such as motor vehicles and aircraft.

Section 176(c) of the CAA provides that a federal agency cannot support an activity in any way unless the federal agency determines that the activity will conform to the State Implementation Plan's purpose of attaining and maintaining the NAAQS. In accordance with this part of the Act, U.S. EPA announced promulgation of its final conformity rule for general federal actions for nonattainment and maintenance areas in the November 30, 1993, Federal Register (40 CFR 51). The final rule does not apply to the disposal and reuse of K. I. Sawyer AFB because of the attainment status of the region. As such, it is not necessary for the Air Force to prepare a conformity determination for the disposal of the K. I. Sawyer AFB property.

4.4.3.1 Proposed Action

Construction. Fugitive dust would be generated during the construction of aviation support, industrial, and residential land uses proposed as part of this alternative. These emissions would be greatest during site clearing and grading activities. Uncontrolled fugitive dust (particulate matter) emissions from ground-disturbing activities are estimated to be emitted at a rate of 110 pounds per acre per working day or 1.2 tons per acre per month (U.S. EPA, 1985). The PM_{10} fraction of the total fugitive dust emissions is assumed to be 50 percent, or 0.6 ton per acre per month (55 pounds per acre per working day).

It is estimated that construction activities would disturb a total of 341 acres in the first 10 years of the Proposed Action (1995-2005), with an average disturbance of 1.19 acres per day during the period from 1995 to 2000, and 1.18 acres per day in the period from 2000 to 2005. These levels of disturbance would release an estimated 65.4 pounds (0.033 ton) per day from 1995 to 2000 and 65.0 pounds (0.033 ton) per day from 2000 to 2005. Based on the assumption that 115 days per year are used for site preparation, total fugitive PM_{10} emissions from construction activity would be 3.76 tons per year and 3.74 tons per year for the same two time periods, respectively. The impact of these PM_{10} emissions would cause elevated short-term particulate concentrations at receptors located close to the construction areas. However, the elevated concentrations would be temporary and would decrease rapidly with distance from the site.

Combustive emissions from construction equipment associated with the new development activities were calculated based on an average emission factor and the amount of land to be developed per time interval. For each acre of land developed, 1,095 pounds of NO_x, 3,820 pounds of CO, 100 pounds of

SO_x, 85 pounds of PM_{10}, and 290 pounds of VOCs would be emitted from construction equipment. The total combustive emissions due to construction would be 18.73 tons per year of NO_x, 65.32 tons per year of CO, 1.71 tons per year of SO_x, 1.45 tons per year of PM_{10}, and 4.96 tons per year of VOCs from 1995 to 2000. Based on the assumption that construction equipment is active 230 days per year, the daily combustive emissions in that period would be 0.081, 0.284, 0.007, 0.006, and 0.022 ton per day for the same pollutants, respectively. Emissions of NO_x, CO, SO_x, PM_{10}, and VOCs in the period from 2000 to 2005 would be 18.62 tons per year (0.081 ton per day), 64.94 tons per year (0.282 ton per day), 1.70 tons per year (0.007 ton per day), 1.45 tons per year (0.006 ton per day), and 4.93 tons per year (0.021 ton per day), respectively.

Operation. A summary of construction and operation emissions for the Proposed Action is presented in Table 4.4-1 for 2000 and 2005. Fugitive dust and construction equipment emissions were calculated as described above. Aircraft operation emissions were calculated using the EDMS model. Estimates for all other categories of emissions were calculated using the methodologies as described in Appendix I.

Table 4.4-1. Emissions Associated with the Proposed Action (tons per day)

Pollutant	Marquette County [a]	K. I. Sawyer AFB		Reuse-Related Emissions [b]	
		Preclosure	Closure		
	1992	1992	1995 [c]	2000	2005
NO_x	1,558.5	1.23	0.041	0.950	1.336
CO	51.8	5.86	0.062	3.431	5.098
SO_2	1,093.4	0.41	0.068	0.390	0.411
PM_{10}	171.5	0.45	0.000	0.059	0.061
VOCs	12.6	2.42	0.003	1.072	1.844

Notes: (a) Includes Marquette County (excluding K. I. Sawyer AFB) point, area, and mobile source emissions for NO_x, CO, and VOCs. Only point source emissions were available for SO_2 and PM_{10}. Area and mobile source emissions were calculated by the Base Realignment and Closure Air Emission Factor Calculator model.
(b) Future year emissions include both construction and operation emissions.
(c) Value of 0.000 indicates emissions are less than 0.003 ton per day.
CO = carbon monoxide
NO_x = nitrogen oxides
PM_{10} = particulate matter equal to or less than 10 microns in diameter
SO_2 = sulfur dioxide
VOCs = volatile organic compounds

Potential impacts to air quality as a result of operational emissions from the Proposed Action were evaluated in terms of two spatial scales: regional and

local. The regional-scale analysis considered the potential for total reuse-related emissions to cause the air shed to reach nonattainment for any pollutant as indicated by large increases in the regional pollutant inventories (NO_2, CO, SO_2, PM_{10}, and VOC emissions). The local-scale analysis evaluated the potential for aircraft emissions to exceed the NAAQS in the immediate vicinity of the base.

Regional Scale. Emissions of criteria pollutants from the Proposed Action are greater than emissions that would be associated with closure of the base. However, with the exception of NO_x emissions after the year 2000, the increased emissions would be less than or equal to those under preclosure conditions. As discussed below, it is not expected that the Proposed Action would cause the region to become nonattainment for any pollutant.

Ozone Precursors. Table 4.4-1 provides a comparison of emission estimates for Marquette County (preclosure), K. I. Sawyer AFB (preclosure and closure), and the Proposed Action at 5- and 10-year increments after closure (i.e., for 2000 and 2005). Table 4.4-1 shows that, although the reuse-related emissions of VOCs would increase from closure conditions by 1.841 tons per day in 2005, the emissions would remain below preclosure levels throughout the 10-year analysis period. By 2005, the total reuse-related VOC emissions would be 76.2 percent of the preclosure emissions at K. I. Sawyer AFB. By 2005, reuse-related emissions of NO_x would increase by 1.295 tons per day over closure conditions. However, total reuse-related emissions of NO_x in 2005 would increase by only 0.106 ton per day over the preclosure level of NO_x emissions. This amount of increase represents less than 0.01 percent of the Marquette County inventory of NO_x emissions, and would not be sufficient to jeopardize continued attainment of the ozone NAAQS.

NO_2, CO, SO_2, and PM_{10}. Table 4.4-1 provides a means to compare emissions from the Proposed Action to 1992 Marquette County emissions and base preclosure and closure emission levels. All NO_x emissions in Table 4.4-1 are assumed to convert to NO_2 emissions on a regional basis. Reuse-related NO_2, CO, SO_2, and PM_{10} emissions would increase by 1.295, 5.036, 0.343, and 0.061 tons per day, respectively, over closure conditions. However, with the exception of NO_x emissions, all reuse-related emissions would be less than or equal to preclosure emission levels. NO_x emissions would increase existing Marquette County levels by less than 0.01 percent. Therefore, emissions of primary pollutants from the Proposed Action would not affect maintenance of the attainment status of the respective pollutant standards.

Local Scale. A summary of the EDMS analysis for the Proposed Action is presented in Table 4.4-2. The modeling results show that during peak hours of airport operation, the maximum 1-hour pollutant concentration would

Table 4.4-2. Air Quality Modeling Results for Airport Operations Associated with the Proposed Action ($\mu g/m^3$)

Pollutant	Averaging Time	K. I. Sawyer AFB Preclosure 1992	Reuse-Related Impact[a] 2000	Reuse-Related Impact[a] 2005	Background Concentration[b]	Limiting Standard[c]
Carbon monoxide	8-hour	310	201	245	5,000	10,000
	1-hour	443	287	350	20,000	40,000
Sulfur dioxide	Annual	3.6	0.9	1.0	11.7	80
	24-hour	14.6	3.6	4.2	103.7	365
	3-hour	32.8	8.2	9.4	279.3	1,300
PM_{10}	Annual	32.1	1.1	1.3	13	50
	24-hour	128.4	4.6	5.2	76	150

Notes: (a) Pollutant concentrations determined from Emission and Dispersion Modeling System results. Concentrations represent impacts due to emissions from operation of K. I. Sawyer AFB as a civilian airport.

(b) Except for carbon monoxide, background concentrations were assumed to equal the mean of maximum concentrations measured during the period 1990-1992 (refer to Table 3.4-4). The carbon monoxide background concentration was assumed to be equal to half of the NAAQS.

(c) Limiting standard is equal to the NAAQS. Total impacts are determined by comparing the aggregate of reuse-related impact and background concentrations to the limiting standard.

$\mu g/m^3$ = micrograms per cubic meter

NAAQS = National Ambient Air Quality Standards

PM_{10} = particulate matter equal to or less than 10 microns in diameter

occur at a receptor located approximately 700 meters south of the south end of the runway, assuming a wind direction parallel to the runway. The primary contributing factor would be aircraft exhaust emitted during takeoffs. The modeling results indicate that maximum concentrations, when added to representative background concentrations, would not exceed the NAAQS in the immediate area surrounding the airport. Therefore, emissions from airport activities under the Proposed Action would have no adverse impact on the local air quality.

Mitigation Measures. The modeling results in Table 4.4-2 show that localized project impacts would not be adverse. Therefore, mitigation of these impacts would not be required.

Conformity with State/Local Plans. NEPA requires that agencies identify any inconsistency of a proposed action with any approved state or local plans and laws. As stated above, emissions from the Proposed Action are not expected to have an adverse impact on local or regional air quality and, therefore, are not expected to interfere with the attainment status of the region. In relation to this issue, U.S. EPA has promulgated detailed procedures for determining conformity with state and local air quality plans for nonattainment areas (40 CFR 51.853[b]). Under this rule, conformity determinations are not required for actions which would result in either no emission increase or in an emission increase that is clearly de minimis. Those actions are defined to include actions like those being considered

here: transfer of land, facilities, title, and real properties through an enforceable contract or lease agreement where the delivery of the deed is required to occur promptly after a specific reasonable condition is met (such as meeting the remedial action requirements of CERCLA) and where the Federal agency does not retain continuing authority to control emissions associated with the land, facilities, title, or real properties. However, if U.S. EPA promulgates conformity procedures in attainment areas, property recipients may be required to prepare a conformity determination on their actions.

4.4.3.2 International Wayport Alternative

Construction. Construction impacts from the International Wayport Alternative would be less than those under the Proposed Action primarily because of the smaller amount of disturbance under this alternative. Applying the same assumptions discussed in the Proposed Action, it is estimated that construction activities would disturb an average of 1.09 acres per day from 1995 to 2000, and 0.33 acre per day from 2000 to 2005. These levels of disturbance would release an estimated 60.1 pounds (0.030 ton) per day and 18.0 pounds (0.009 ton) per day for the same two time periods, respectively. The impact of these PM_{10} emissions would cause elevated short-term particulate concentrations at receptors located close to the construction areas. However, the elevated concentrations would be temporary and would decrease rapidly with distance from the site.

Combustive emissions from construction equipment associated with the new development activities were calculated based on average emission factors and the amount of land to be developed per time interval. The total combustive emissions due to construction would be 0.075 ton per day of NO_x, 0.261 ton per day of CO, 0.007 ton per day of SO_x, 0.006 ton per day of PM_{10}, and 0.020 ton per day of VOCs from 1995 to 2000. Emissions of NO_x, CO, SO_x, PM_{10}, and VOCs from 2000 to 2005 would be 0.022, 0.078, 0.002, 0.002, and 0.006 ton per day, respectively.

Operation. A summary of construction and operation emissions for the International Wayport Alternative is presented in Table 4.4-3 for the years 2000 and 2005.

Regional Scale. Emissions of criteria pollutants from the International Wayport Alternative would be greater than emissions associated with closure of the base. However, with the exception of NO_x emissions after 2000, the emissions would be less than those under preclosure conditions. As discussed below, it is not expected that the International Wayport Alternative would cause the region to become nonattainment for any pollutant.

Table 4.4-3. Emissions Associated with the International Wayport Alternative (tons per day)

Pollutant	Marquette County [a] 1992	K. I. Sawyer AFB Preclosure 1992	K. I. Sawyer AFB Closure 1995 [c]	Reuse-Related Emissions [b] 2000	Reuse-Related Emissions [b] 2005
NO_x	1,558.5	1.23	0.041	1.224	1.816
CO	51.8	5.86	0.062	4.205	5.314
SO_2	1,093.4	0.41	0.068	0.371	0.386
PM_{10}	171.5	0.45	0.000	0.054	0.041
VOCs	12.6	2.42	0.003	0.513	0.709

Notes: (a) Includes Marquette County (excluding K. I. Sawyer AFB) point, area, and mobile source emissions for NO_x, CO, and VOCs. Only point source emissions were available for SO_2 and PM_{10}. Area and mobile source emissions were calculated by the Base Realignment and Closure Air Emission Factor Calculator model.
(b) Future year emissions include both construction and operation emissions.
(c) Value of 0.000 indicates emissions are less than 0.003 ton per day.
CO = carbon monoxide
NO_x = nitrogen oxides
PM_{10} = particulate matter equal to or less than 10 microns in diameter
SO_2 = sulfur dioxide
VOCs = volatile organic compounds

Ozone Precursors. Table 4.4-3 provides a comparison of emission estimates for Marquette County (preclosure), K. I. Sawyer AFB (preclosure and closure), and the International Wayport Alternative at 5- and 10-year increments after closure (i.e., for 2000 and 2005). Table 4.4-3 shows that, although the reuse-related emissions for VOCs would increase from closure conditions by 0.706 ton per day in 2005, the emissions would remain below preclosure levels throughout the 10-year analysis period. By 2005, the total reuse-related VOC emissions would be 29.3 percent of the preclosure emissions at K. I. Sawyer AFB. By 2005, reuse-related emissions for NO_x would increase by 1.775 tons per day over closure conditions. However, total reuse-related emissions of NO_x in 2005 would increase by only 0.586 ton per day over the preclosure level of NO_x emissions. This amount of increase represents less than 0.04 percent of the Marquette County inventory of NO_x emissions and would not be sufficient to jeopardize continued attainment of the ozone NAAQS.

NO_2, CO, SO_2, and PM_{10}. Table 4.4-3 provides a means for comparing emissions from the International Wayport Alternative to 1992 Marquette County emissions and base preclosure and closure emission levels. All NO_x emissions in Table 4.4-3 are assumed to convert to NO_2 emissions on a regional basis. Reuse-related NO_2, CO, SO_2, and PM_{10} emissions would increase by 1.775, 5.252, 0.318, and 0.041 tons per day, respectively, over closure conditions. However, with the exception of NO_x emissions, all reuse-related emissions would be less than preclosure emission levels. NO_x emissions would increase existing Marquette County levels by less than 0.04 percent. Emission increases of the primary pollutants from the

International Wayport Alternative would, therefore, not affect maintenance of the attainment status of the respective pollutant standards.

Local Scale. A summary of the EDMS analysis for the International Wayport Alternative is presented in Table 4.4-4. The modeling results show that during peak hours of airport operation, the maximum 1-hour pollutant concentration would occur at a receptor located 700 meters south of the south end of the main runway, assuming a wind direction parallel to the runway. The primary contributing factor would be aircraft exhaust emitted during takeoffs. The modeling results indicate that maximum concentrations, when added to representative background concentrations, would not exceed the NAAQS in the immediate area surrounding the airport. Emissions from airport activities under the International Wayport Alternative would, therefore, have no adverse impact on the local air quality.

Table 4.4-4. Air Quality Modeling Results for Airport Operations Associated with the International Wayport Alternative ($\mu g/m^3$)

Pollutant	Averaging Time	K. I. Sawyer AFB Preclosure 1992	Reuse-Related Impact[a] 2000	Reuse-Related Impact[a] 2005	Background Concentration[b]	Limiting Standard[c]
Carbon monoxide	8-hour	310	230	382	5,000	10,000
	1-hour	443	328	546	20,000	40,000
Sulfur dioxide	Annual	3.6	2.7	5.7	11.7	80
	24-hour	14.6	10.9	22.6	103.7	365
	3-hour	32.8	24.6	50.9	279.3	1,300
PM_{10}	Annual	32.1	1.8	3.4	13	50
	24-hour	128.4	7.0	13.6	76	150

Notes: (a) Pollutant concentrations determined from Emission and Dispersion Modeling System results. Concentrations represent impacts due to emissions from operation of K. I. Sawyer AFB as a civilian airport.
(b) Except for carbon monoxide, background concentrations assumed to equal the mean of maximum concentrations measured during the period 1990-1992 (Refer to Table 3.4-4). The carbon monoxide background concentration was assumed to be equal to half of the NAAQS.
(c) Limiting standard is equal to the NAAQS. Total impacts are determined by comparing the aggregate of reuse-related impact and background concentrations to the limiting standard.

$\mu g/m^3$ = micrograms per cubic meter
NAAQS = National Ambient Air Quality Standards
PM_{10} = particulate matter equal to or less than 10 microns in diameter

Mitigation Measures. The modeling results in Table 4.4-4 show that localized project impacts would not be adverse. Therefore, mitigation of these impacts would not be required.

Conformity with State/Local Plans. As discussed for the Proposed Action, if U.S. EPA promulgates conformity procedures in attainment areas, property

recipients may be required to prepare a conformity determination on their actions.

4.4.3.3 Commercial Aviation Alternative

Construction. Applying the same assumptions discussed in the Proposed Action, an average of 1.64 and 0.05 acre per day would be disturbed under the Commercial Aviation Alternative from 1995 to 2000 and 2000 to 2005, respectively. These levels of disturbance would release an estimated 0.045 ton per day and 0.001 ton per day of PM_{10} during each of the respective time periods. The impact of these emissions would cause short-term elevated concentrations of particulates at receptors close to the construction areas. The concentrations would decrease rapidly with distance from the site.

Combustion emissions from construction equipment were calculated in the same manner as described for the Proposed Action. The total combustive emissions due to construction would be 0.113 ton per day of NO_x, 0.394 ton per day of CO, 0.010 ton per day of SO_x, 0.009 ton per day of PM_{10}, and 0.030 ton per day of VOCs from 1995 to 2000. Emissions of NO_x, CO, SO_x, PM_{10}, and VOCs from 2000 to 2005 would be 0.003, 0.012, less than 0.001, less than 0.001, and 0.001 ton per day, respectively.

Operation. Table 4.4-5 summarizes the results of the construction and operation emission calculations associated with the Commercial Aviation Alternative for 2000 and 2005.

Table 4.4-5. Emissions Associated with the Commercial Aviation Alternative (tons per day)

	Marquette County [a]	K. I. Sawyer AFB		Reuse-Related Emissions [b]	
		Preclosure	Closure		
Pollutant	1992	1992	1995 [c]	2000	2005
NO_x	1,558.5	1.23	0.041	0.621	0.648
CO	51.8	5.86	0.062	2.870	3.434
SO_2	1,093.4	0.41	0.068	0.358	0.349
PM_{10}	171.5	0.45	0.000	0.072	0.020
VOCs	12.6	2.42	0.003	0.421	0.461

Notes: (a) Includes Marquette County (excluding K. I. Sawyer AFB) point, area, and mobile source emissions for NO_x, CO, and VOCs. Only point source emissions were available for SO_2 and PM_{10}. Area and mobile source emissions were calculated by the Base Realignment and Closure Air Emission Factor Calculator model.
(b) Future year emissions include both construction and operation emissions.
(c) Value of 0.000 indicates emissions are less than 0.003 ton per day.
CO = carbon monoxide
NO_x = nitrogen oxides
PM_{10} = particulate matter equal to or less than 10 microns in diameter
SO_2 = sulfur dioxide
VOCs = volatile organic compounds

Regional Scale. The evaluation of regional-scale impacts from the Commercial Aviation Alternative considered the effect that reuse-related air emissions would have on the air quality attainment status of Marquette County. As with the Proposed Action, emissions from this alternative would not jeopardize the attainment status of any criteria pollutant. The following paragraphs summarize the results of the regional-scale impact analysis on a pollutant-by-pollutant basis.

Ozone Precursors. Table 4.4-5 shows that total reuse-related emissions for VOCs in 2005 would increase by 0.458 ton per day over closure conditions, but would remain well below preclosure emission levels throughout the analysis period. By 2005, the estimated reuse-related VOC emissions would be about 19 percent of the preclosure emissions at K. I. Sawyer AFB. NO_x emissions in 2005 would increase by 0.607 ton per day over closure conditions and would be approximately 53 percent of preclosure levels on base.

NO_2, CO, SO_2, and PM_{10}. Reuse-related emissions of these criteria pollutants would increase from closure levels as shown in Table 4.4-5 (all NO_x are assumed to convert to NO_2 on a regional basis). However, total reuse-related emissions would be less than total preclosure emission levels for each pollutant. Air quality impacts from emissions associated with the Commercial Aviation Alternative would be minor and would not adversely affect the current attainment status of any pollutant.

Local Scale. A summary of the EDMS analysis for the Commercial Aviation Alternative is presented in Table 4.4-6. The modeling results show that during peak hours of airport operation, the maximum 1-hour pollutant 106 concentration would occur at a receptor located approximately 700 meters from the south end of the runway, assuming a wind direction parallel to the runway. The primary contributing factor would be aircraft exhaust emitted during takeoffs. The modeling results indicate that maximum concentrations when added to representative background concentrations would not exceed the NAAQS in the immediate area surrounding the airport. Emissions from airport activities under the Commercial Aviation Alternative would, therefore, have no adverse impact on the local air quality.

Mitigation Measures. The modeling results in Table 4.4-6 show that localized project impacts would not be adverse. Therefore, mitigation would not be required.

Conformity with State/Local Plans. As discussed for the Proposed Action, if U.S. EPA promulgates conformity procedures in attainment areas, property recipients may be required to prepare a conformity determination on their actions.

Table 4.4-6. Air Quality Modeling Results for Airport Operations Associated with the Commercial Aviation Alternative ($\mu g/m^3$)

Pollutant	Averaging Time	K. I. Sawyer AFB Preclosure 1992	Reuse-Related Impact[a] 2000	Reuse-Related Impact[a] 2005	Background Concentration[b]	Limiting Standard[c]
Carbon monoxide	8-hour	310	175	216	5,000	10,000
	1-hour	443	250	309	20,000	40,000
Sulfur dioxide	Annual	3.6	0.2	0.2	11.7	80
	24-hour	14.6	0.8	0.9	103.7	365
	3-hour	32.8	1.7	1.9	279.3	1,300
PM_{10}	Annual	32.1	0.7	0.8	13	50
	24-hour	128.4	2.7	3.1	76	150

Notes: (a) Pollutant concentrations determined from Emission and Dispersion Modeling System results. Concentrations represent impacts due to emissions from operation of K. I. Sawyer AFB as a civilian airport.

(b) Except for carbon monoxide, background concentrations assumed to equal the mean of maximum concentrations measured during the period 1990-1992 (Refer to Table 3.4-4). The carbon monoxide background concentration was assumed to be equal to half of the NAAQS.

(c) Limiting standard is equal to the NAAQS. Total impacts are determined by comparing the aggregate of reuse-related impact and background concentrations to the limiting standard.

$\mu g/m^3$ = micrograms per cubic meter
NAAQS = National Ambient Air Quality Standards
PM_{10} = particulate matter equal to or less than 10 microns in diameter

4.4.3.4 Recreation Alternative

Construction. Construction impacts from the Recreation Alternative would occur due to the generation of fugitive dust during the development of the industrial, institutional, and recreation land use areas. An average of 0.68 acre per day would be disturbed from 1995 to 2005. This level of disturbance would release an estimated 0.019 ton per day of PM_{10}. The impact of these emissions would cause short-term elevated concentrations of particulates at receptors close to the construction areas. However, the elevated concentrations would be temporary and would decrease rapidly with distance from the site.

Combustion emissions from construction equipment were calculated in the same manner described for the Proposed Action. The total combustive emissions due to construction would be 0.047 ton per day of NO_x, 0.164 ton per day of CO, 0.004 ton per day of SO_x, 0.004 ton per day of PM_{10}, and 0.012 ton per day of VOCs from 1995 to 2005.

Operation. Table 4.4-7 summarizes the results of the construction and operation emission calculations for the Recreation Alternative for 2000 and 2005.

Table 4.4-7. Emissions Associated with the Recreation Alternative (tons per day)

Pollutant	Marquette County [a] 1992	K. I. Sawyer AFB Preclosure 1992	K. I. Sawyer AFB Closure 1995 [c]	Reuse-Related Emissions [b] 2000	Reuse-Related Emissions [b] 2005
NO_x	1,558.5	1.23	0.041	0.309	0.353
CO	51.8	5.86	0.062	0.852	1.119
SO_2	1,093.4	0.41	0.068	0.346	0.346
PM_{10}	171.5	0.45	0.000	0.024	0.024
VOCs	12.6	2.42	0.003	0.213	0.240

Notes: (a) Includes Marquette County (excluding K. I. Sawyer AFB) point, area, and mobile source emissions for NO_x, CO, and VOCs. Only point source emissions were available for SO_2 and PM_{10}. Area and mobile source emissions were calculated by the Base Realignment and Closure Air Emission Factor Calculator model.

(b) Future year emissions include both construction and operation emissions.

(c) Value of 0.000 indicates emissions are less than 0.003 ton per day.

CO = carbon monoxide
NO_x = nitrogen oxides
PM_{10} = particulate matter equal to or less than 10 microns in diameter
SO_2 = sulfur dioxide
VOCs = volatile organic compounds

Regional Scale. Emissions from this alternative would not jeopardize the attainment status of any criteria pollutant. The following paragraphs summarize the results of the regional-scale impact analysis on a pollutant-by-pollutant basis.

Ozone Precursors. Table 4.4-7 shows that total reuse-related emissions for VOCs in 2005 would increase by 0.237 ton per day over closure conditions, but would remain well below preclosure emission levels throughout the analysis period. By 2005, the estimated reuse-related VOC emissions would be about 10 percent of the preclosure emissions at K. I. Sawyer AFB. NO_x emissions in 2005 would increase by 0.312 ton per day over closure conditions and would be approximately 29 percent of preclosure levels on base.

NO_2, CO, SO_2, and PM_{10}. Reuse-related emissions of these criteria pollutants would increase from closure levels as shown in Table 4.4-7 (all NO_x assumed to convert to NO_2 on a regional basis). However, total reuse-related emissions would be less than total preclosure emission levels for each pollutant. Air quality impacts from emissions associated with the Recreation Alternative would be minor and would not adversely affect the current attainment status of any pollutant.

Local Scale. No local scale modeling was performed for this alternative. Under the Recreation Alternative, no aircraft operations would occur and

there would be no new major point sources. In addition, the existing background pollutant concentrations would generally be less than half of the ambient standards, and reuse-related emissions would be less than preclosure emission levels. Therefore, local air quality impacts would be expected to be similar to or less than preclosure conditions.

Mitigation Measures. No adverse impacts are anticipated under this alternative; therefore, no mitigation measures are required.

Conformity with State/Local Plans. As discussed for the Proposed Action, if U.S. EPA promulgates conformity procedures in attainment areas, property recipients may be required to prepare a conformity determination on their actions.

4.4.3.5 No-Action Alternative. The No-Action Alternative would generate emissions as described under closure baseline conditions (see Table 4.4-1). Due to the low level of emissions produced from No-Action Alternative activities, no adverse air quality impacts would occur.

Mitigation Measures. Air quality mitigation measures would not be required for the No-Action Alternative.

4.4.3.6 Other Land Use Concepts. Potential changes to air quality resulting from the implementation of the other land use concepts are described below.

Michigan Army National Guard. Potential changes in air quality resulting from implementation of the MANG land use concept would be negligible. Minimal ground disturbance activities, motor vehicle traffic, heating requirements, or other emission-producing activity would occur under this scenario.

Correctional Institution. Emissions would be generated during the construction and operation phases associated with this land use concept. Construction phase impacts would result from the generation of fugitive dust during construction and infrastructure improvement activities. These impacts would be similar to those generated by the reuse alternatives for commercial development in this area. It is estimated that 161 acres would be disturbed by construction for this proposed reuse, with an estimated 0.03 ton per day of PM_{10} released during this phase. These emissions would cause elevated concentrations of particulates at receptors close to the construction areas. The concentrations would decrease rapidly with distance from the site.

The activities associated with this land use concept during the operation phase would generate emissions from heating, power equipment, and motor vehicles of employees and visitors. Potential changes in air quality resulting

from implementation of this land use concept in conjunction with the Proposed Action would be negligible. Implementation of this concept would result in a net increase of emissions (mainly from increased vehicle traffic) under the International Wayport, Commercial Aviation, Recreation, and No-Action alternatives. Impacts would be similar to those described under the Proposed Action.

Sawmill. The sawmill is proposed to produce between 45 and 75 million board-feet of lumber annually. The construction phase for this land use concept would involve minimal ground disturbance (2 acres) and construction activities lasting less than 1 year; therefore, emissions during the construction phase are expected to be minimal.

Emissions of criteria pollutants would result from the various operations associated with the sawmill, including log debarking, log sawing, sawdust handling, and operation of a wood-fired boiler. Emissions of PM_{10} from the sawmill would be approximately 0.04 ton per day, as calculated using estimated production yields, U.S. EPA emission factors, and conservative emission control efficiencies. These emissions would cause elevated concentrations of particulates at receptors close to the site; particulate concentrations would decrease rapidly with distance from the site. Emissions of other pollutants would be negligible.

Implementation of this land use concept in conjunction with the other reuse alternatives would result in impacts similar to those described for the other reuse alternatives; however, all stationary sources of the sawmill would be subject to the applicable federal and state new source review program for stationary sources. The reuse proponent would be required to determine the potential-to-emit for each new source in the permit application process. Appropriate control technology, emissions monitoring, and reporting requirements would be specified in any air quality permits issued.

Waste to Energy/Recycling. The proposed resource recovery system would impact air quality during long-term operations. This land use concept would generate emissions of criteria pollutants and HAPs during long-term operations. Large stationary sources would include the boilers and incineration processes. Smaller stationary sources would include generators, storage tanks, and other area sources from miscellaneous industrial processes and equipment usage. Mobile sources would include on-road transport and support vehicles, as well as miscellaneous off-road sources.

The proposed land use concept would be subject to the applicable federal and state new source review program for new stationary sources. The reuse proponent must conduct further air quality analyses to determine the new sources' potential-to-emit and PSD applicability for specific project plans. The permit-to-operate would be subject to the review and approval of the MDNR-AGD. The appropriate state and federal permit requirements and

conditions would be issued and implemented in accordance with relevant state and federal air quality regulations. Conditions of the air permits would establish the appropriate control technology, preconstruction and long-term emissions monitoring, and record keeping and reporting requirements to comply with federal new source performance standards. The waste to energy/recycling concept may also be subject to the provisions of Section 112r of the CAA for the prevention of accidental releases for the storage of hazardous chemicals associated with the power plant and emissions control technologies. Compliance with the applicable federal and state permit requirements and conditions would preclude adverse impacts from criteria and HAP emissions during operations.

Indirect emissions would include on- and off-site vehicular traffic emissions from commuting employees and delivery trucks. These on-road motor vehicle emissions would be similar to those discussed under the Proposed Action and reuse alternatives.

Waste to Energy/Environmental Support Operations. Impacts to air quality from this concept would be similar to those for the waste to energy/ recycling concept described above.

4.4.4 Noise

Environmental impact analysis related to noise includes the potential effects on the local human and animal populations. This analysis will estimate the extent and magnitude of noise levels generated by the alternatives, using the predictive models discussed below. The baseline noise conditions and predicted noise levels will then be assessed with respect to land use impacts. Potential annoyance, speech and sleep interference, hearing loss, and effects of noise on health are discussed. The metrics used to evaluate noise are DNL and L_{eq}, which are supplemented occasionally by SEL and A-weighted maximum sound level. These metrics are measured in units of A-weighted dB. See Appendix J for an expanded discussion of these metrics.

Methods used to quantify the effects of noise such as annoyance, speech and sleep interference, health, and hearing loss have undergone extensive scientific development during the past several decades. The most reliable measures at present are noise-induced hearing loss and annoyance. Extra-auditory effects (those not directly related to hearing capability) are also important, although they are not as well understood. The current scientific consensus is that "evidence from available research reports is suggestive, but it does not provide definitive answers to the question of health effects, other than to the auditory system, of long-term exposure to noise" (National Academy of Sciences, 1981). The effects of noise are summarized within this section and a detailed description is provided in Appendix J.

Annoyance. Noise annoyance is defined by U.S. EPA as any negative subjective reaction to noise on the part of an individual or group. Table 4.4-8 presents the results of over a dozen studies of transportation modes, including airports, investigating the relationship between noise and annoyance levels. This relationship has been suggested by the National Academy of Sciences (1977) and recently re-evaluated (Fidell et al., 1989) for use in describing people's reactions to semi-continuous (transportation) noise. These data are shown to provide a perspective on the level of annoyance that might be anticipated. For example, 15 to 25 percent of persons exposed to DNL 65 to 70 dB would be highly annoyed by the noise levels.

Table 4.4-8. Percentage of Population Highly Annoyed by Noise Exposure

DNL Interval in dB	Percentage of Persons Highly Annoyed
Less than 65	Less than 15
65-70	15-25
70-75	25-37
75-80	37-52

dB = decibel
DNL = day-night average sound level

Source: Adapted from National Academy of Sciences, 1977.

Speech Interference. One of the ways that noise affects daily life is by prevention or impairment of speech communication. In a noisy environment, understanding speech is diminished when speech signals are masked by intruding noises. Reduced intelligibility of speech may also have other effects; for example, if the understanding of speech is interrupted, performance may be reduced, annoyance may increase, and learning may be impaired. Research suggests that aircraft flyover noises that exceed approximately 60 dB (instantaneous sound level) interfere with speech communication (Bennett and Pearsons, 1981; Crook and Langdon, 1974). Increasing the level of the flyover noise maximum to 80 dB will reduce the intelligibility to zero, even if the person speaks in a loud voice. This interference lasts as long as the event, which is momentary for a flyover.

Sleep Interference. The effects of noise on sleep are of concern, primarily in assuring suitable residential environments. DNL incorporates consideration of sleep disturbance by assigning a 10 dB penalty to nighttime noise events. SEL may be used to supplement DNL in evaluating sleep disturbance. When SEL is used to evaluate sleep disturbance, studies have correlated SEL values with the percent of people awakened. The relationships between percent awakened and SEL are presented in Appendix J. Most of these

relationships, however, do not reflect habituation, and therefore would not address long-term sleep disturbance effects. SEL takes into account an event's sound intensity, frequency content, and time duration, by measuring the total A-weighted sound energy of the event and incorporating it into a single number. Unlike DNL, which describes the daily average noise exposure, SEL describes the normalized noise from a single flyover, called an event.

Studies show great variability in the percentage of people awakened by exposure to noise (Goldstein and Lukas, 1980; Lukas, 1975). A recent review (Pearsons et al., 1989) of the literature related to sleep disturbance, including field and laboratory studies, suggests that habituation may reduce the effect of noise on sleep. The authors point out that the relationship between noise exposure and sleep disturbance is complex and affected by the interaction of many variables. The large differences between the findings of the laboratory and field studies make it difficult to determine the best relationship to use. The method developed by Lukas would estimate seven times more awakening than the field results reported by Pearsons.

Land Use Compatibility. Estimates of total noise exposure resulting from aircraft operations, as expressed using DNL, can be interpreted in terms of the compatibility with designated land uses. The Federal Interagency Committee on Urban Noise developed land use compatibility guidelines for noise (U.S. DOT, 1980). Based upon these guidelines, suggested compatibility guidelines for evaluating land uses in aircraft noise exposure areas were developed by the FAA and are presented in Section 3.4.4. The land use compatibility guidelines are based on annoyance and hearing loss. Part 150 of the FAA regulations describes the procedures, standards, and methodology governing the development, submission, and review of airport noise exposure maps and airport noise compatibility programs. It prescribes use of yearly DNL in the evaluation of airport noise environments. It also identifies those land use types that are normally compatible with various levels of exposure. Compatible or incompatible land use is determined by comparing the predicted DNL level at a site with the recommended land uses.

Noise Modeling. In order to define the noise impacts from aircraft takeoff, landing, runups, and touch-and-go operations at K. I. Sawyer AFB, the FAA-developed Integrated Noise Model (INM) version 4.11 was utilized to predict 65, 70, and 75 DNL noise contours and SEL values for noise-sensitive receptors. Appendix J defines these descriptors. The contours were generated for the Proposed Action, International Wayport Alternative, and Commercial Aviation Alternative for three future year projections (5, 10, and 20 years after closure). Input data to INM include information on aircraft types; runway use; takeoff and landing flight tracks; aircraft altitude, speeds, and engine power settings; and number of daytime (7:00 a.m. to 10:00 p.m.) and nighttime (10:00 p.m. to 7:00 a.m.) operations.

Surface vehicle traffic-noise levels for roadways in the vicinity of K. I. Sawyer AFB were analyzed using the Federal Highway Administration's Highway Noise Model (Federal Highway Administration, 1978). This model incorporates vehicle mix, traffic volume projections, day/night split, and speed to generate DNL.

Major Assumptions. Half of all aircraft operations were assumed to be takeoffs and half were assumed to be landings. Operations are presented in Appendix J in detail, including flight tracks (incoming and outgoing), aircraft operations, and fleet mix. Vicinity flight tracks assumed for modeling are shown in Figures 4.4-1 (Proposed Action, Commercial Aviation Alternative) and 4.4-2 (International Wayport Alternative). All operations were assumed to follow standard glide slopes and takeoff profiles provided by the FAA's INM.

Major roads leading to or around the base were analyzed. Traffic data used to project future noise levels were derived from information gathered in the traffic analysis presented in Section 4.2.3. Traffic data used in this analysis are presented in Appendix J.

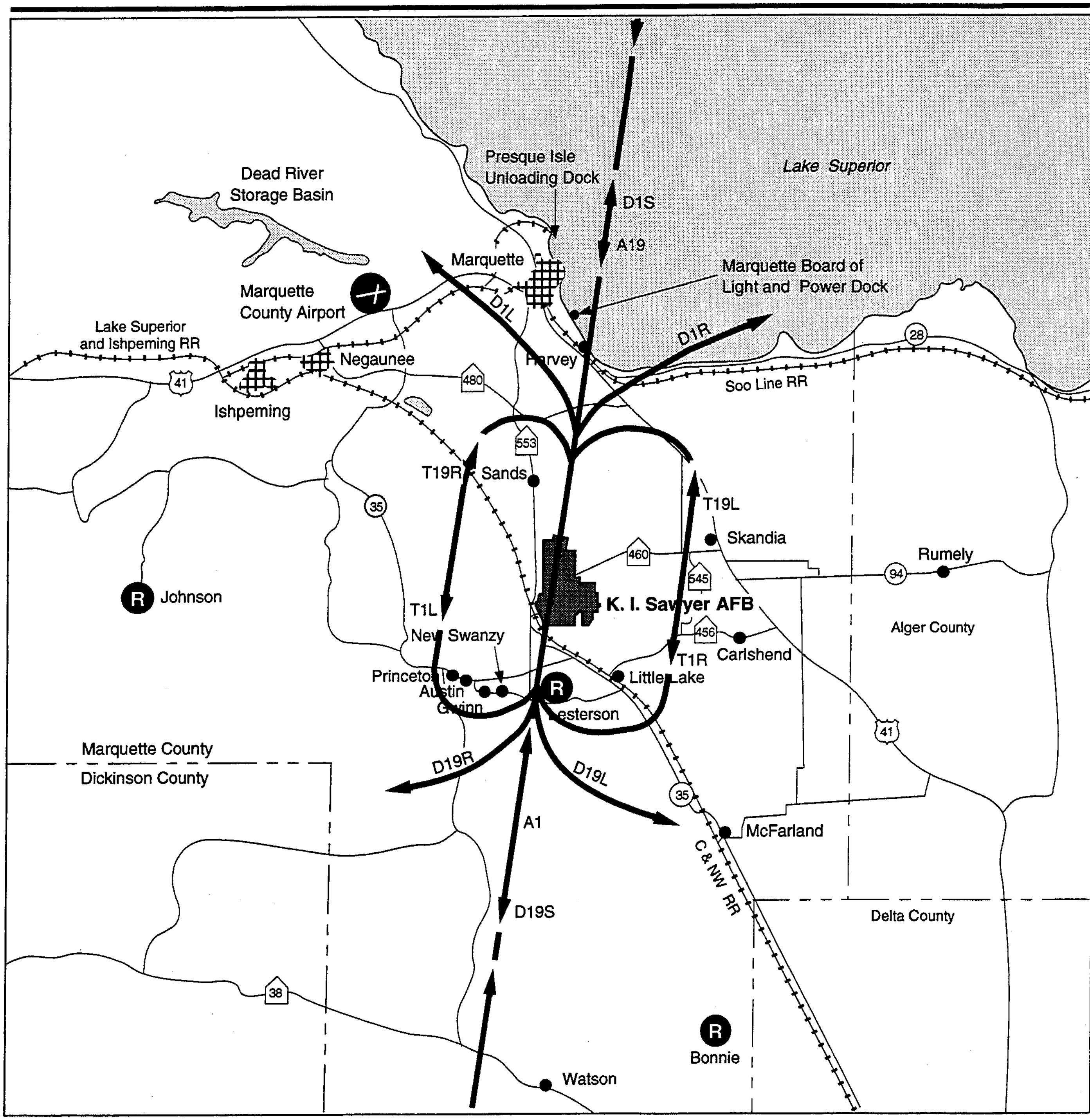
4.4.4.1 Proposed Action. The results of the aircraft noise modeling for the Proposed Action are presented as noise contours in Figures 4.4-3 through 4.4-5. The contribution from runup noise is evident as separate contours at the southeast edge of the apron.

Table 4.4-9 presents the approximate number of acres and estimated population within each DNL range for each of the study years. Compared to the preclosure reference, this represents a decrease of 26,786 acres within the DNL 65 dB contour in 2000, 26,785 acres in 2005, and 26,665 acres in 2015. The maximum exposure is projected for 2015, due to increasing operations.

The criteria that define Stage 2 and Stage 3 aircraft are described in FAA Part 36 (FAA, 1988b). Noise level limits are defined for takeoff, approach, and sideline measurements. No Stage 2 aircraft operations were modeled for the Proposed Action.

SEL was calculated at representative residential locations as shown in Figure 4.4-6 for the noisiest and most common jet aircraft; the results are presented in Table 4.4-10. The analysis suggests that, for the Proposed Action, some aircraft overflights could affect the sleep of some residents in the area.

For all model years the noisiest aircraft would be the 747-400 and MD-11, with the most common air cargo aircraft being the 747-400. The noisiest military aircraft would be the F-16, and the most common general air carrier aircraft would be the ATR-42. The noisiest aircraft were determined from



EXPLANATION

Flight Paths

U.S. Highway

State Highway

County Road

Restricted/Private Use Airport

Public Use Airport

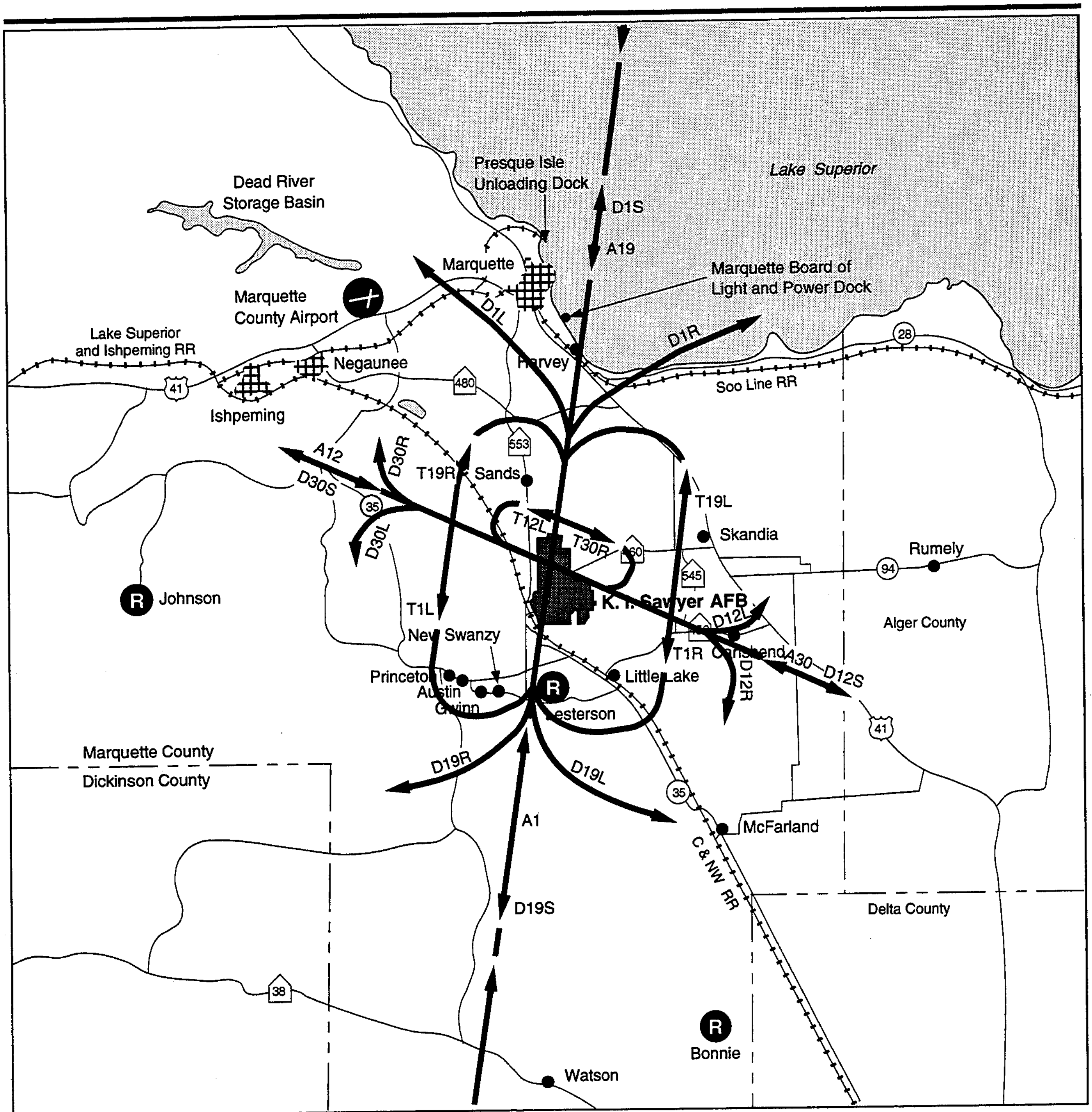
County Line

C & NW Chicago and Northwestern

0 2 4 8 Miles

Civilian Flight Tracks-Proposed Action and Commercial Aviation Alternative

Figure 4.4-1



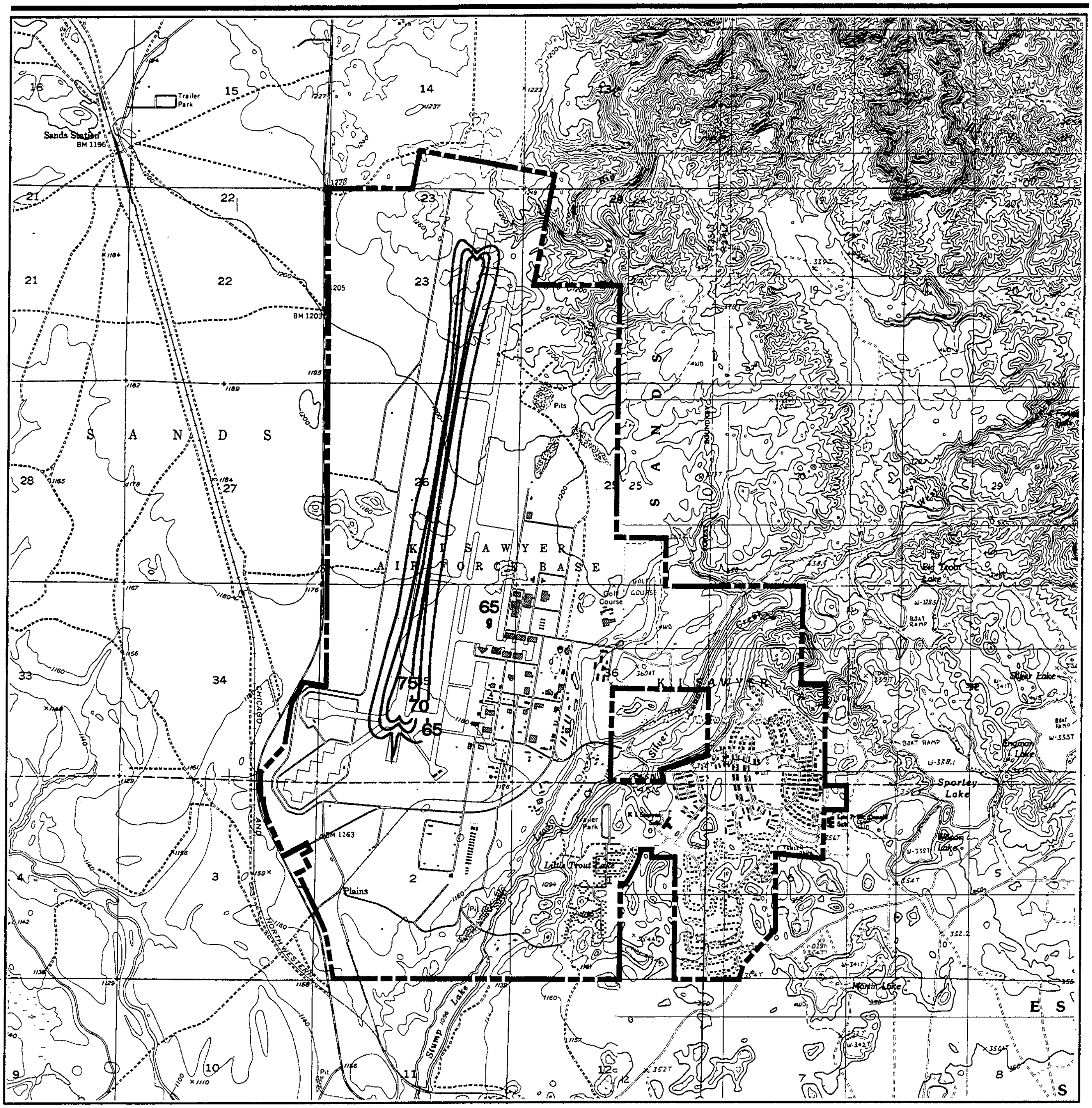
EXPLANATION

- Flight Paths
- U.S. Highway
- State Highway
- County Road
- Restricted/Private Use Airport
- Public Use Airport
- County Line
- C & NW — Chicago and Northwestern

0 2 4 8 Miles

Civilian Flight Tracks-International Wayport Alternative

Figure 4.4-2



EXPLANATION

— — — — Base Boundary

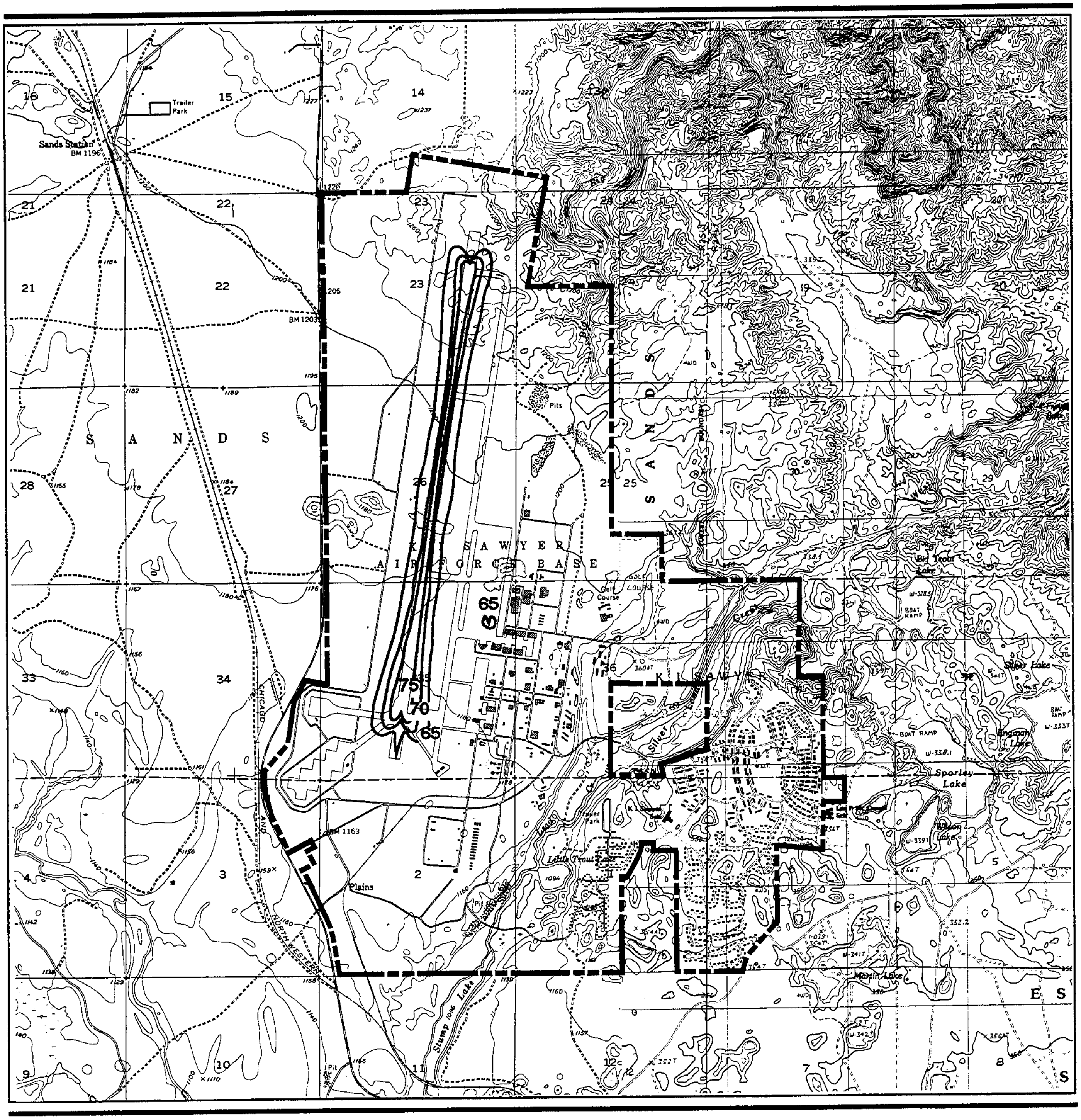
—— 65 —— DNL Noise Contours (5 dB intervals)

Day-Night Average Sound Level Proposed Action (2000)

0 1000 2000 4000 Feet

Source: U.S.G.S. 7.5 min.
Harvey, MI 1985, Little Lake, MI 1985,
Sands, MI 1975, Gwinn, MI 1975

Figure 4.4-3



EXPLANATION

— — — — Base Boundary

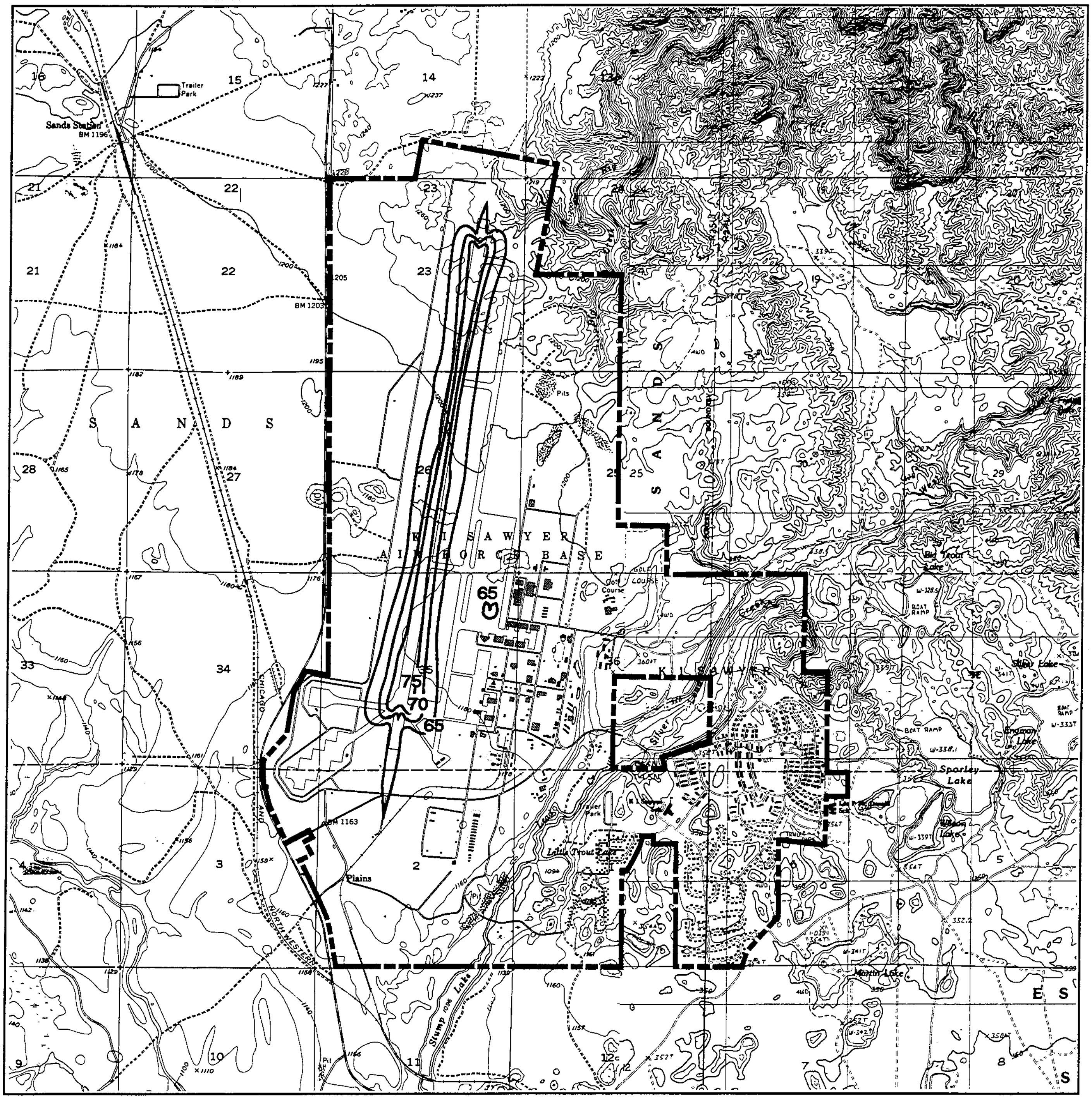
—— 65 —— DNL Noise Contours (5 dB intervals)

0 1000 2000 4000 Feet

Source: U.S.G.S. 7.5 min.
Harvey, MI 1985, Little Lake, MI 1985,
Sands, MI 1975, Gwinn, MI 1975

Day-Night Average Sound Level Proposed Action (2005)

Figure 4.4-4

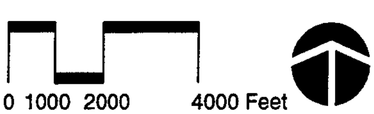


EXPLANATION

— — — — Base Boundary

—— 65 —— DNL Noise Contours (5 dB intervals)

Day-Night Average Sound Level Proposed Action (2015)



Source: U.S.G.S. 7.5 min.
Harvey, MI 1985, Little Lake, MI 1985,
Sands, MI 1975, Gwinn, MI 1975

Figure 4.4-5

Table 4.4-9. Aircraft DNL Exposure for the Reuse Alternatives

		DNL in dB						
		65-70		70-75		>75		Total
Year	Alternative	Acres	Population	Acres	Population	Acres	Population	>65 Acres
2000	Proposed Action	170	0	74	0	59	0	303
	International Wayport	194	0	93	0	80	0	367
	Commercial Aviation	59	0	24	0	14	0	97
2005	Proposed Action	167	0	79	0	58	0	304
	International Wayport	353	0	171	0	133	0	657
	Commercial Aviation	65	0	27	0	18	0	110
2015	Proposed Action	230	0	114	0	80	0	424
	International Wayport	533	0	227	0	188	0	948
	Commercial Aviation	75	0	31	0	19	0	125

dB = decibel
DNL = day-night average sound level
> = greater than

the A-weighted maximum sound level as presented in FAA Advisory Circular AC 36-3F (FAA, 1990c).

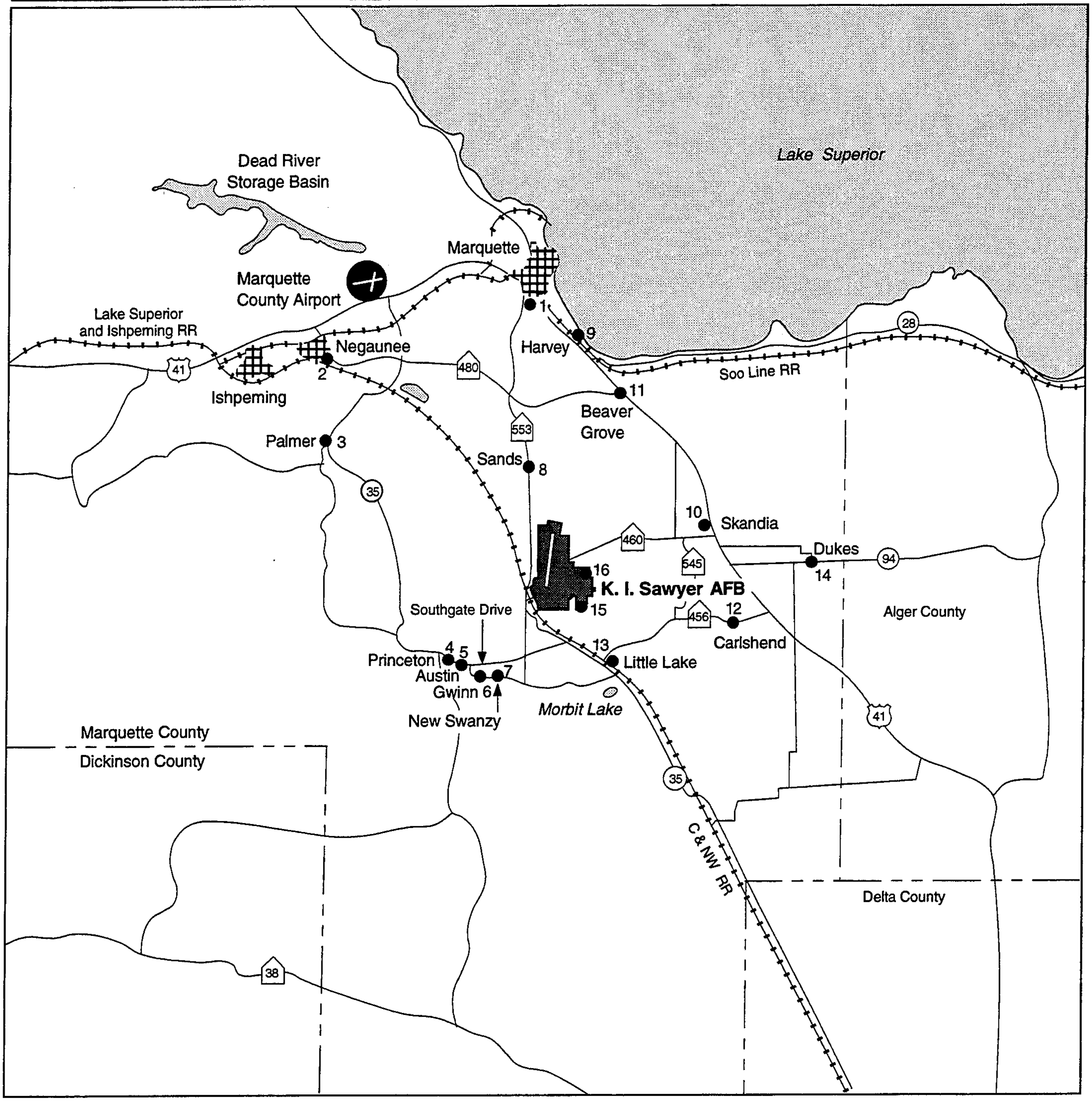
Surface traffic sound levels for several road segments are presented in Table 4.4-11. These levels are presented in terms of DNL as a function of distance from the centerline of the roadways analyzed. There would be an estimated 708 residents in areas exposed to DNL 65 dB or greater due to surface traffic by 2015. This is an increase of 184 people over the No-Action Alternative.

Mitigation Measures. Measures that could be considered to reduce the effects of airport noise include:

- **Operational/management measures** - Change takeoff, climbout, or landing procedures; change flight tracks; limit or rotate primary runway usage; enforce prescribed flight track use and fan out departure flight tracks; impose curfews; impose noise-related landing fees; develop noise monitoring systems; and establish community relations office.

- **Preventive measures** - Acquire undeveloped land adjacent to the runway that is exposed to aircraft noise of DNL 65 dB or greater, and restrict residential and hospital development to areas outside the DNL 65 dB contour.

Other mitigation measures such as a sound insulation program could be implemented to reduce interior noise levels for sensitive receptors exposed



EXPLANATION

●	SEL Receptor Locations	(airport symbol)	Public Use Airport
(41)	U.S. Highway	— — — —	County Line
(35)	State Highway	C & NW	Chicago and Northwestern
(38)	County Road		

0 2 4 8 Miles

Sound Exposure Level (SEL) Receptor Locations

Figure 4.4-6

Table 4.4-10. Sound Exposure Levels at Representative Noise Receptors, Proposed Action and Alternatives

No.	Community	Receptor Location	Sound Exposure Level (dB) Aircraft Type						
			747-400	MD-11	757-200	Gulfstream IV	ATR-72	ATR-42	F-16
1	Marquette	Houses near intersection of Pioneer Road and CR 553	71	66	62	62	65	58	60
2	Negaunee	Houses near intersection of Brown and Main	70	64	60	61	63	57	58
3	Palmer	Houses near Post Office	62	56	50	52	51	50	46
4	Princeton	Houses near intersection of Miner Drive and SH 35	83	80	75	76	80	67	76
5	Austin	Houses near intersection of Austin Street and Low Street	82	80	75	76	79	67	77
6	Gwinn	Houses near SH 35 at east edge of town	75	73	68	69	71	62	73
7	New Swanzy	Houses near SH 35 at east edge of town	77	75	70	71	73	63	75
8	Sands	Houses near CR 553	87	84	78	79	82	69	82
9	Harvey	Houses near intersection of SH 28 and U.S. 41	80	77	72	72	76	64	69
10	Skandia	Houses near intersection of Townhall and Kreiger	61	55	49	52	50	51	47
11	Beaver Grove	Houses near U.S. 41 south of CR 480	70	67	62	62	64	58	62
12	Carlshend	Houses near intersection of CR 456 and CR 541	58	52	45	48	46	50	42
13	Little Lake	Houses near intersection of SH 35 and CR 456	73	71	66	67	68	61	68
14	Dukes	Houses near intersection of SH 94 and Dukes Road	55	48	41	45	41	48	36
15	On base	South edge of housing	74	71	65	67	83	68	68
16	On base	North edge of housing	74	70	64	64	83	75	64

CR = County Road
dB = decibel
SH = State Highway
U.S. = # U.S. Highway

Table 4.4-11. Distance to DNL from Roadway Center and Number of People - Proposed Action

Year	Roadway	Segment	Distance (feet) DNL 65 dB	Number of Residents	Distance (feet) DNL 70 dB	Number of Residents	Distance (feet) DNL 75 dB	Number of Residents
2000	CR 462	Main Gate to CR 553	30	0	20	0	(a)	NA
	CR 460	Gate 2 to CR 545	40	0	20	0	(a)	NA
	CR 460	CR 545 to U.S. 41	40	0	20	0	(a)	NA
	CR 480	West of CR 553	100	0	50	0	20	0
	CR 480	CR 553 to U.S. 41	70	17	40	6	20	0
	CR 553	Marquette city limits to CR 480	100	3	50	0	20	0
	CR 553	CR 480 to CR 462	110	81	50	0	30	0
	CR 553	CR 462 to Southgate Drive	110	0	50	0	30	0
	CR 553	Southgate Drive to SH 35	80	0	40	0	20	0
	CR 545	U.S. 41 to CR 460	20	0	(a)	NA	(a)	NA
	CR 545	CR 460 to CR 456	20	0	(a)	NA	(a)	NA
	CR 456	SH 35 to CR 545	50	11	20	0	(a)	NA
	CR 456	CR 545 to U.S. 41	30	0	10	0	(a)	NA
	U.S. 41	SH 28 to Skandia	120	201	60	14	30	3
	U.S. 41	Skandia to SH 94	90	3	40	0	20	0
	U.S. 41	SH 94 to CR 456	60	0	30	0	(a)	NA
	SH 35	CR 553 to CR 456	60	11	30	0	(a)	NA
	SH 35	CR 456 to Morbit Lake Access	20	0	(a)	NA	(a)	NA
2005	CR 462	Main Gate to CR 553	50	0	30	0	(a)	NA
	CR 460	Gate 2 to CR 545	60	0	30	0	(a)	NA
	CR 460	CR 545 to U.S. 41	50	0	30	0	(a)	NA
	CR 480	West of CR 553	120	6	50	0	30	0
	CR 480	CR 553 to U.S. 41	80	39	40	6	20	0
	CR 553	Marquette city limits to CR 480	120	8	60	3	30	0
	CR 553	CR 480 to CR 462	150	84	70	22	30	0
	CR 553	CR 462 to Southgate Drive	150	0	70	0	30	0
	CR 553	Southgate Drive to SH 35	100	0	50	0	30	0
	CR 545	U.S. 41 to CR 460	30	3	20	0	(a)	NA
	CR 545	CR 460 to CR 456	20	0	(a)	NA	(a)	NA
	CR 456	SH 35 to CR 545	50	8	30	3	10	0
	CR 456	CR 545 to U.S. 41	40	0	20	0	(a)	NA
	U.S. 41	SH 28 to Skandia	130	220	60	14	30	0
	U.S. 41	Skandia to SH 94	100	6	50	0	30	0
	U.S. 41	SH 94 to CR 456	70	0	30	0	20	0
	SH 35	CR 553 to CR 456	80	25	40	0	20	0
	SH 35	CR 456 to Morbit Lake Access	30	0	20	0	(a)	NA
2015	CR 462	Main Gate to CR 553	70	0	40	0	20	0
	CR 460	Gate 2 to CR 545	90	0	40	0	20	0
	CR 460	CR 545 to U.S. 41	70	0	30	0	20	0
	CR 480	West of CR 553	150	8	70	0	40	0
	CR 480	CR 553 to U.S. 41	110	89	50	6	30	0
	CR 553	Marquette city limits to CR 480	170	17	80	3	40	0
	CR 553	CR 480 to CR 462	210	56	100	67	50	0
	CR 553	CR 462 to Southgate Drive	210	0	100	0	50	0
	CR 553	Southgate Drive to SH 35	130	0	60	0	30	0
	CR 545	U.S. 41 to CR 460	50	11	20	0	(a)	NA
	CR 545	CR 460 to CR 456	30	0	20	0	(a)	NA
	CR 456	SH 35 to CR 545	80	20	40	3	20	0
	CR 456	CR 545 to U.S. 41	50	6	20	0	(a)	NA
	U.S. 41	SH 28 to Skandia	180	285	80	75	40	3
	U.S. 41	Skandia to SH 94	140	6	60	0	30	0
	U.S. 41	SH 94 to CR 456	90	0	40	0	20	0
	SH 35	CR 553 to CR 456	110	47	50	6	30	0
	SH 35	CR 456 to Morbit Lake Access	40	0	20	0	(a)	NA

Note: (a) Contained within the roadway.
CR = County Road
dB = decibel
DNL = day-night average sound level
NA = not applicable
SH = State Highway
U.S.# = U.S. Highway

to DNL 65 dB or greater. Noise reduction inside buildings can be accomplished by incorporating solid core wood or steel-faced exterior doors, non-opening dual pane windows, and aggregate block walls into building design, and limiting the total square footage of windows to no more than 10 percent of exterior exposed walls. These features can reduce interior noise levels by as much as 26 to 53 A-weighted dB when properly designed and constructed. For future development, county and township land use planning could incorporate noise compatibility measures when establishing residential zoning. Measures such as restricting residential development to areas outside the DNL 65 dB contour and incorporating buffer zones into community development could be used. The effectiveness of the operational and management noise mitigation measures presented here cannot be completely determined without extensive modeling and/or noise measurements.

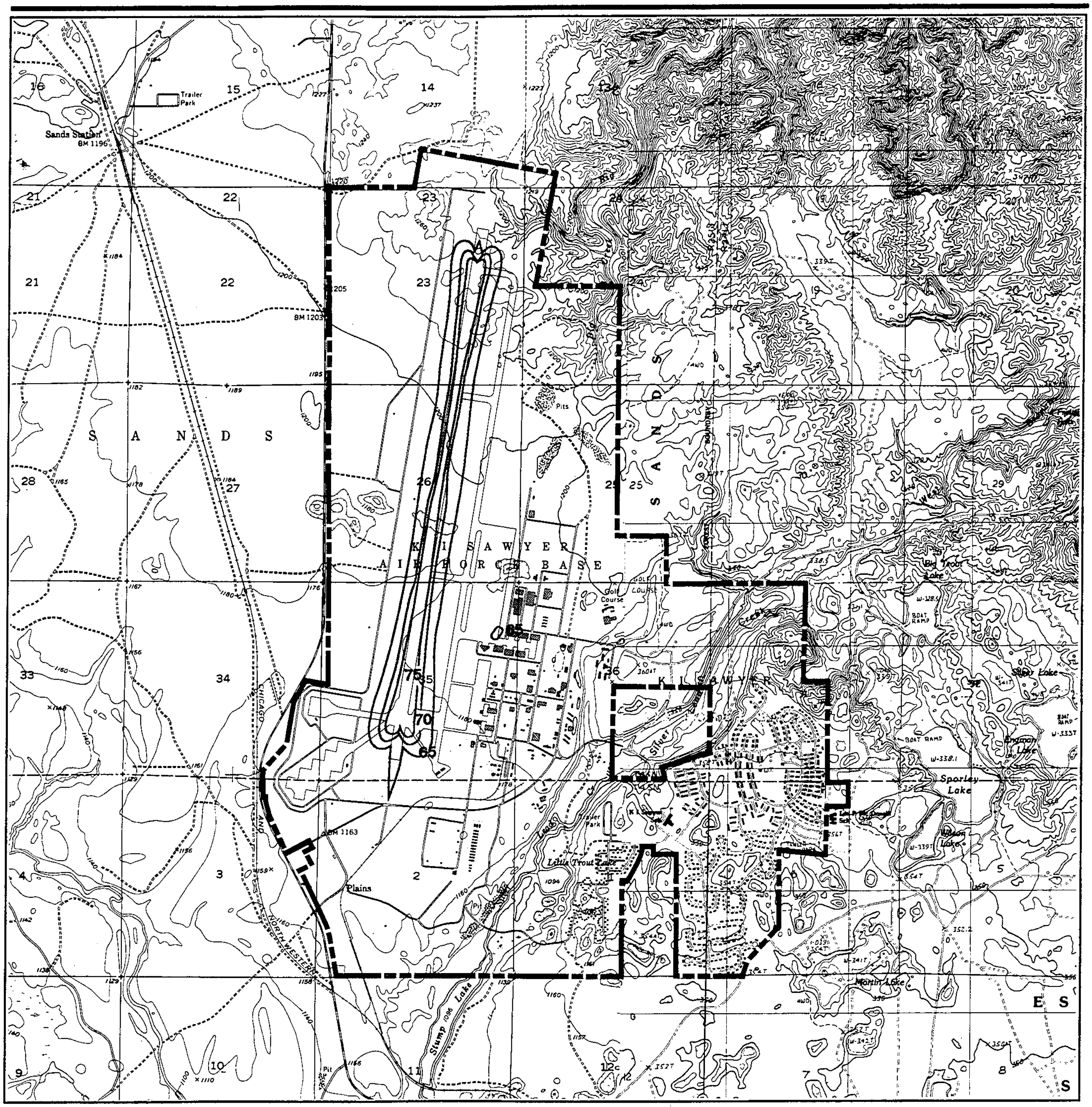
4.4.4.2 International Wayport Alternative. The primary flight tracks for the International Wayport Alternative are presented in Figure 4.4-2. The results of the aircraft noise modeling for the International Wayport Alternative are presented as noise contours in Figures 4.4-7 through 4.4-9. The contribution from runup noise is evident as separate contours at the southeast.

Table 4.4-9 presents the approximate number of acres and estimated population within each DNL range for each of the study years for the International Wayport Alternative. Compared to the preclosure reference, this represents a decrease of 26,722 acres within the DNL 65 dB contour in 2000, 26,432 acres in 2005, and 26,141 acres in 2015. The maximum exposure is projected for 2015 due to increasing operations.

The criteria that define Stage 2 and Stage 3 aircraft are described in FAA Part 36 (FAA, 1988b). Noise level limits are defined for takeoff, approach, and sideline measurements. No Stage 2 aircraft operations were modeled for the International Wayport Alternative.

SEL was calculated at representative residential locations for the noisiest and most common jet aircraft; the results are presented in Table 4.4-10. The analysis suggests that, for the International Wayport Alternative, some aircraft overflights could affect the sleep of some residents in the area.

For all model years the noisiest aircraft would be the 747-400 and MD-11, with the most common air carrier/air cargo aircraft being the 757. The noisiest military aircraft would be the F-16, and the most common general aviation jet would be the Gulf Stream IV. The noisiest aircraft were determined from the A-weighted maximum sound level as presented in FAA Advisory Circular AC 36-3F (FAA, 1990c).



EXPLANATION

— — — — Base Boundary

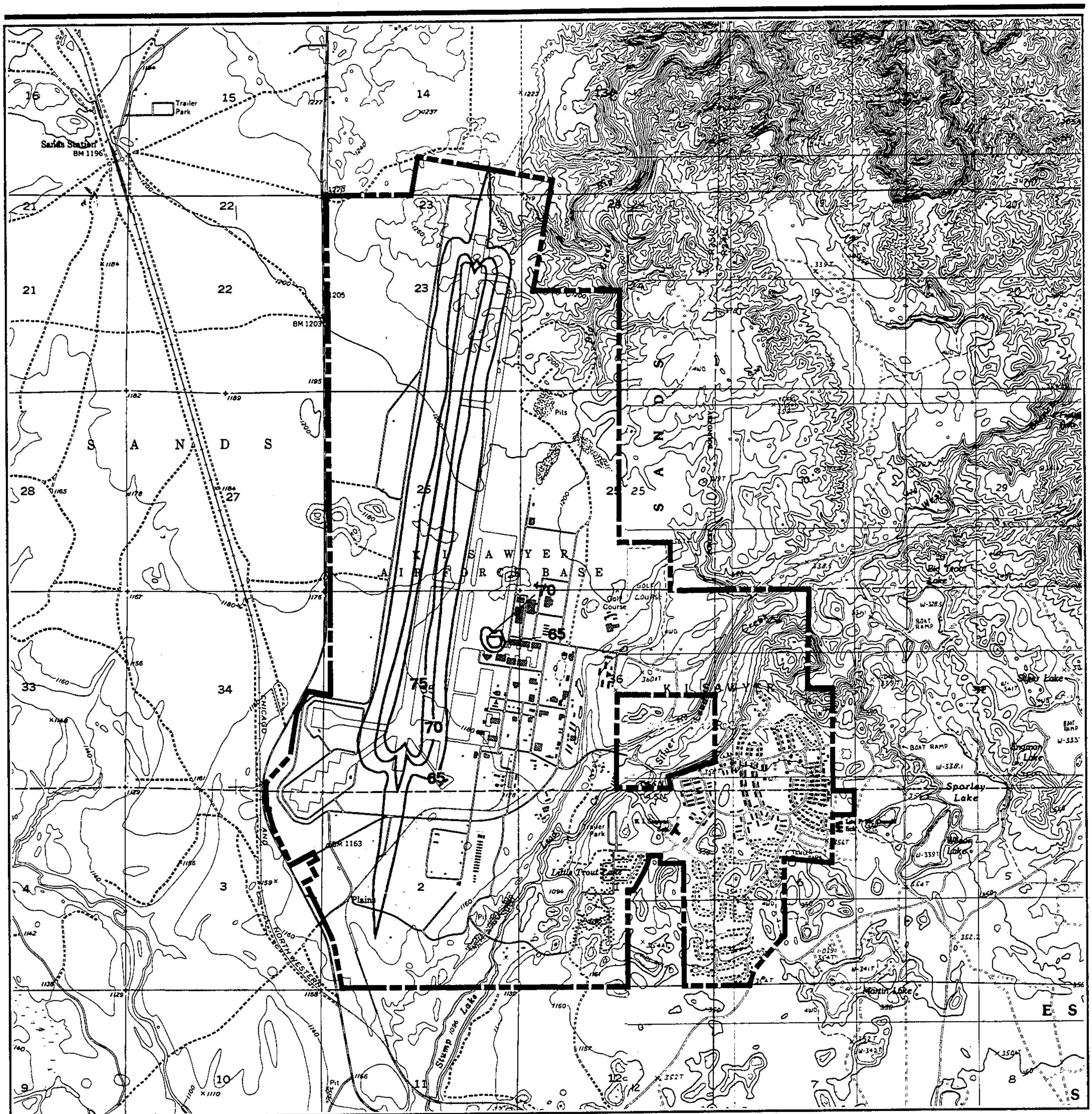
—— 65 —— DNL Noise Contours (5 dB intervals)

Day-Night Average Sound Level International Wayport Alternative (2000)

0 1000 2000 4000 Feet

Source: U.S.G.S. 7.5 min.
Harvey, MI 1985, Little Lake, MI 1985,
Sands, MI 1975, Gwinn, MI 1975

Figure 4.4-7

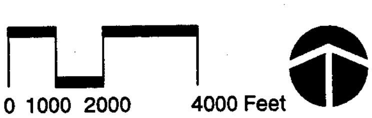


EXPLANATION

— — — — Base Boundary

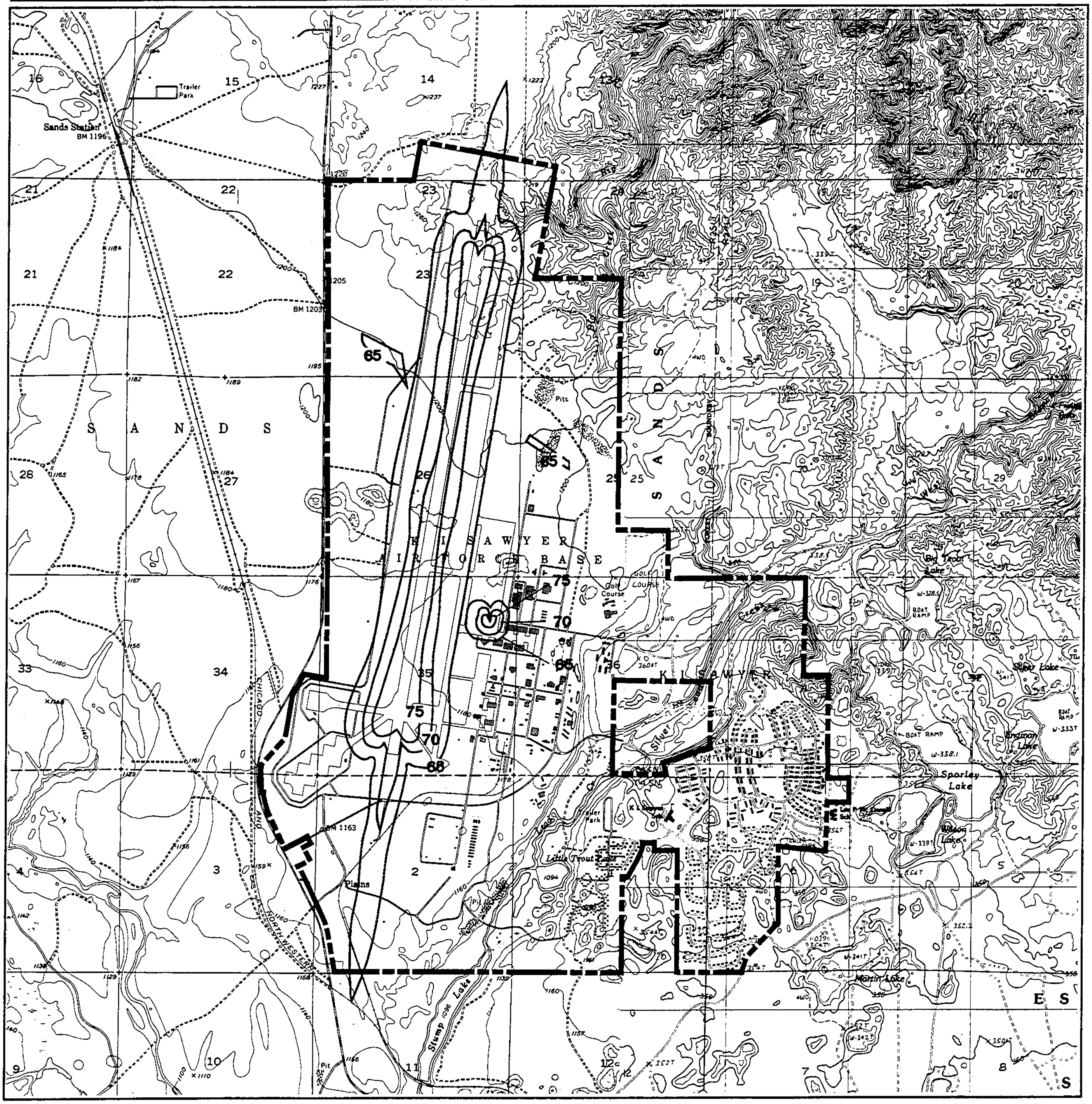
—— 65 —— DNL Noise Contours (5 dB intervals)

Day-Night Average Sound Level International Wayport Alternative (2005)



Source: U.S.G.S. 7.5 min.
Harvey, MI 1985, Little Lake, MI 1985,
Sands, MI 1975, Gwinn, MI 1975

Figure 4.4-8



EXPLANATION

— — — — Base Boundary

—— 65 —— DNL Noise Contours (5 dB intervals)

Day-Night Average Sound Level International Wayport Alternative (2015)

0 1000 2000 4000 Feet

Source: U.S.G.S. 7.5 min.
Harvey, MI 1985, Little Lake, MI 1985,
Sands, MI 1975, Gwinn, MI 1975

Figure 4.4-9

Surface traffic sound levels for several road segments are presented in Table 4.4-12. These levels are presented in terms of DNL as a function of distance from the centerline of the roadways analyzed. There would be an estimated 660 residents in areas exposed to DNL 65 dB or greater due to surface traffic by 2015. This is an increase of 136 people over the No-Action Alternative.

Mitigation Measures. Mitigation measures for the International Wayport Alternative would be the same as for the Proposed Action.

4.4.4.3 Commercial Aviation Alternative. The primary flight tracks for the Commercial Aviation Alternative are presented in Figure 4.4-1. The results of the aircraft noise modeling for the Commercial Aviation Alternative are presented as noise contours in Figures 4.4-10 through 4.4-12.

Table 4.4-7 presents the approximate number of acres and estimated population within each DNL range for each of the study years. Compared to the preclosure reference, this represents a decrease of 26,992 acres within the DNL 65 dB contour in 2000, 26,979 acres in 2005, and 26,964 acres in 2015. The maximum exposure is projected for 2015 due to increasing operations.

The criteria that define Stage 2 and Stage 3 aircraft are described in FAA Part 36 (FAA, 1988b). Noise level limits are defined for takeoff, approach, and sideline measurements. No Stage 2 aircraft operations were modeled for the Commercial Aviation Alternative.

SEL was calculated at representative residential locations for the noisiest and most common jet aircraft; the results are presented in Table 4.4-10. The analysis suggests that, for the Commercial Aviation Alternative, some aircraft overflights could affect the sleep of some residents in the area.

For all model years the noisiest aircraft would be the ATR-72, with the most common commercial aircraft being the ATR-42. The noisiest aircraft were determined from the A-weighted maximum sound level as presented in FAA Advisory Circular AC 36-3F (FAA, 1990c).

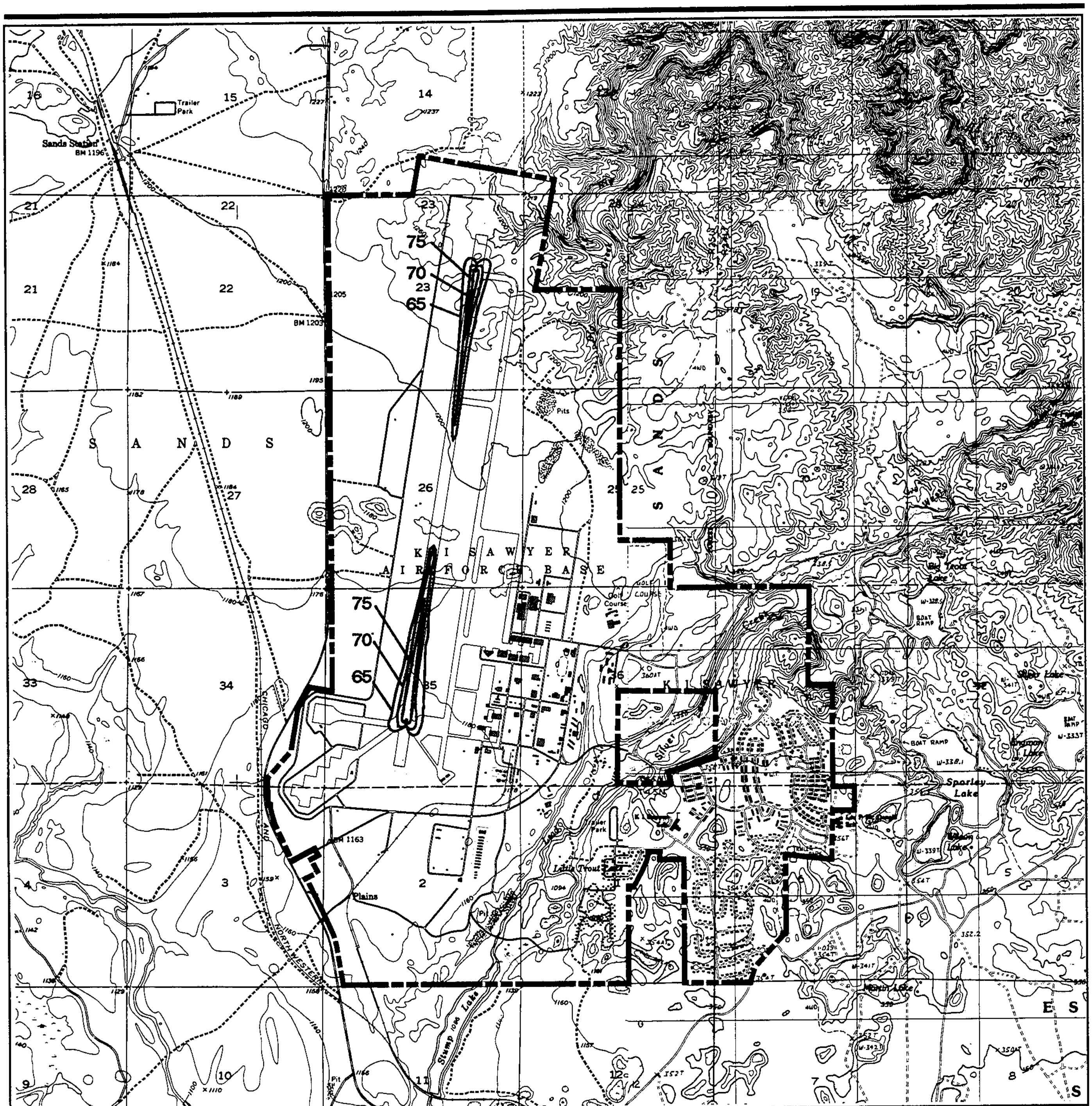
Surface traffic sound levels for several road segments are presented in Table 4.4-13. These levels are presented in terms of DNL as a function of distance from the centerline of the roadways analyzed. There would be an estimated 636 people residing in areas exposed to DNL 65 dB and greater due to surface traffic by 2015. This would be an increase of 112 people over the No-Action Alternative.

Mitigation Measures. Mitigation measures for noise would be the same as those described for the Proposed Action.

Table 4.4-12. Distance to DNL from Roadway Center and Number of People - International Wayport Alternative

Year	Roadway	Segment	Distance (feet) DNL 65 dB	Number of Residents	Distance (feet) DNL 70 dB	Number of Residents	Distance (feet) DNL 75 dB	Number of Residents
2000	CR 462	Main Gate to CR 553	50	0	30	0	(a)	NA
	CR 460	Gate 2 to CR 545	50	0	20	0	(a)	NA
	CR 460	CR 545 to U.S. 41	40	0	20	0	(a)	NA
	CR 480	West of CR 553	100	0	50	0	30	0
	CR 480	CR 553 to U.S. 41	70	17	40	6	20	0
	CR 553	Marquette city limits to CR 480	110	8	50	0	30	0
	CR 553	CR 480 to CR 462	120	78	60	11	30	0
	CR 553	CR 462 to Southgate Drive	120	0	60	0	30	0
	CR 553	Southgate Drive to SH 35	80	0	40	0	20	0
	CR 545	U.S. 41 to CR 460	30	6	10	0	(a)	NA
	CR 545	CR 460 to CR 456	20	0	(a)	NA	(a)	NA
	CR 456	SH 35 to CR 545	50	11	20	0	(a)	NA
	CR 456	CR 545 to U.S. 41	30	0	20	0	(a)	NA
	U.S. 41	SH 28 to Skandia	120	209	50	6	30	3
	U.S. 41	Skandia to SH 94	90	3	40	0	20	0
	U.S. 41	SH 94 to CR 456	60	0	30	0	(a)	NA
	SH 35	CR 553 to CR 456	60	11	30	0	20	0
	SH 35	CR 456 to Morbit Lake Access	20	0	(a)	NA	(a)	NA
2005	CR 462	Main Gate to CR 553	60	0	30	0	(a)	NA
	CR 460	Gate 2 to CR 545	50	0	30	0	(a)	NA
	CR 460	CR 545 to U.S. 41	50	0	30	0	(a)	NA
	CR 480	West of CR 553	120	6	50	0	30	0
	CR 480	CR 553 to U.S. 41	80	39	40	6	20	0
	CR 553	Marquette city limits to CR 480	120	8	60	3	30	0
	CR 553	CR 480 to CR 462	150	84	70	22	30	0
	CR 553	CR 462 to Southgate Drive	140	0	70	0	30	0
	CR 553	Southgate Drive to SH 35	90	0	50	0	20	0
	CR 545	U.S. 41 to CR 460	30	3	20	0	(a)	NA
	CR 545	CR 460 to CR 456	20	0	(a)	NA	(a)	NA
	CR 456	SH 35 to CR 545	50	8	30	3	10	0
	CR 456	CR 545 to U.S. 41	30	0	20	0	(a)	NA
	U.S. 41	SH 28 to Skandia	130	220	60	14	30	3
	U.S. 41	Skandia to SH 94	100	6	50	0	30	0
	U.S. 41	SH 94 to CR 456	70	0	30	0	20	0
	SH 35	CR 553 to CR 456	80	25	40	0	20	0
	SH 35	CR 456 to Morbit Lake Access	30	0	20	0	(a)	NA
2015	CR 462	Main Gate to CR 553	80	0	40	0	20	0
	CR 460	Gate 2 to CR 545	70	0	30	0	20	0
	CR 460	CR 545 to U.S. 41	60	0	30	0	(a)	NA
	CR 480	West of CR 553	150	8	70	0	30	0
	CR 480	CR 553 to U.S. 41	110	89	50	6	30	0
	CR 553	Marquette city limits to CR 480	160	17	80	3	40	0
	CR 553	CR 480 to CR 462	190	67	90	53	40	0
	CR 553	CR 462 to Southgate Drive	190	0	90	0	40	0
	CR 553	Southgate Drive to SH 35	120	0	60	0	30	0
	CR 545	U.S. 41 to CR 460	40	6	20	0	(a)	NA
	CR 545	CR 460 to CR 456	30	0	10	0	(a)	NA
	CR 456	SH 35 to CR 545	70	14	30	3	20	0
	CR 456	CR 545 to U.S. 41	50	6	20	0	(a)	NA
	U.S. 41	SH 28 to Skandia	170	262	80	75	40	3
	U.S. 41	Skandia to SH 94	130	6	60	0	30	0
	U.S. 41	SH 94 to CR 456	90	0	40	0	20	0
	SH 35	CR 553 to CR 456	100	36	50	6	20	0
	SH 35	CR 456 to Morbit Lake Access	40	0	20	0	(a)	NA

Note: (a) Contained within the roadway.
CR = County Road
dB = decibel
DNL = day-night average sound level
NA = not applicable
SH = State Highway
U.S.# = U.S. Highway



EXPLANATION

— — — — Base Boundary

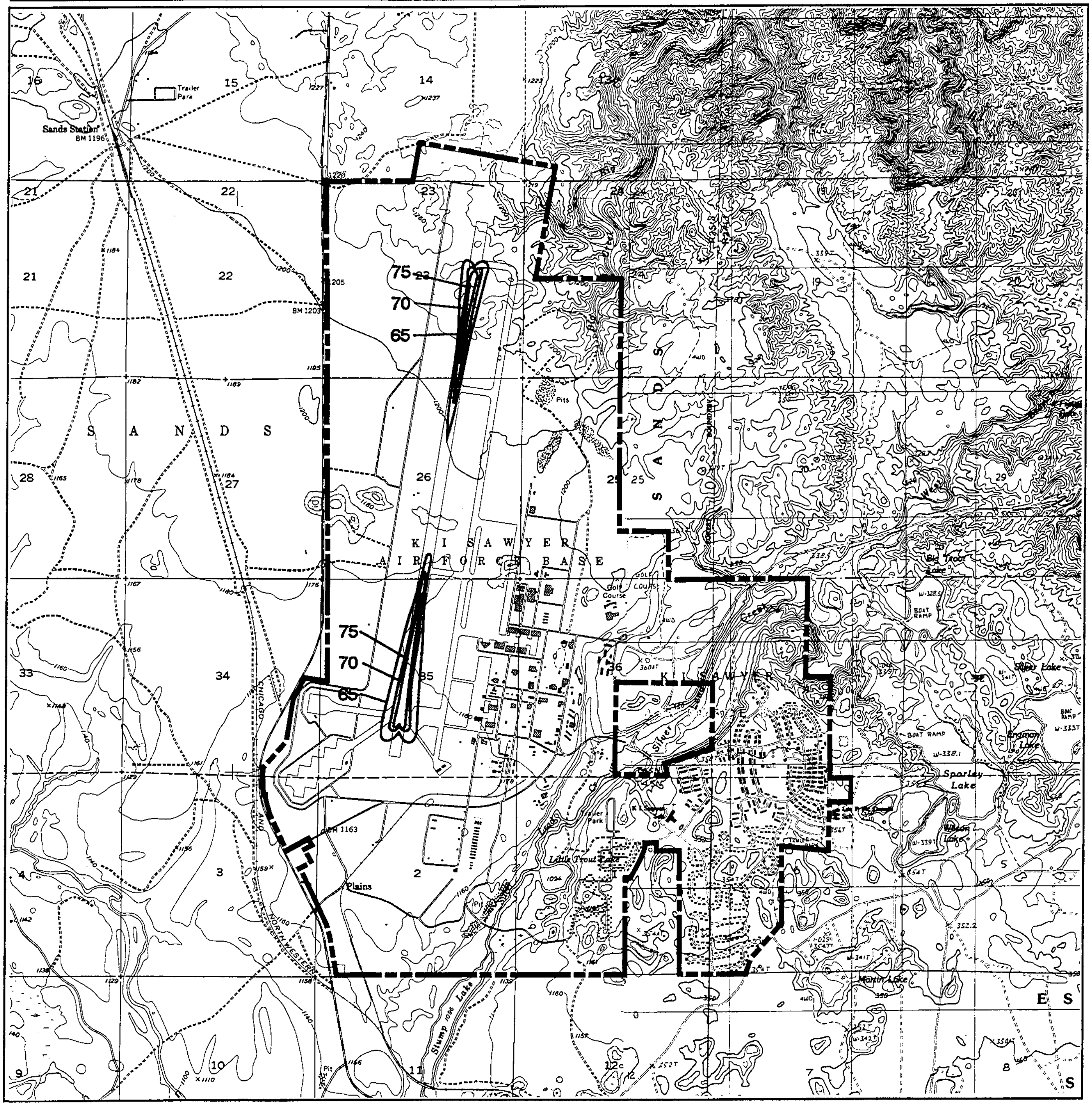
— 65 — DNL Noise Contours (5 dB intervals)

Day-Night Average Sound Level Commercial Aviation Alternative (2000)

0 1000 2000 4000 Feet

Source: U.S.G.S. 7.5 min.
Harvey, MI 1985, Little Lake, MI 1985,
Sands, MI 1975, Gwinn, MI 1975

Figure 4.4-10



EXPLANATION

— — — — Base Boundary

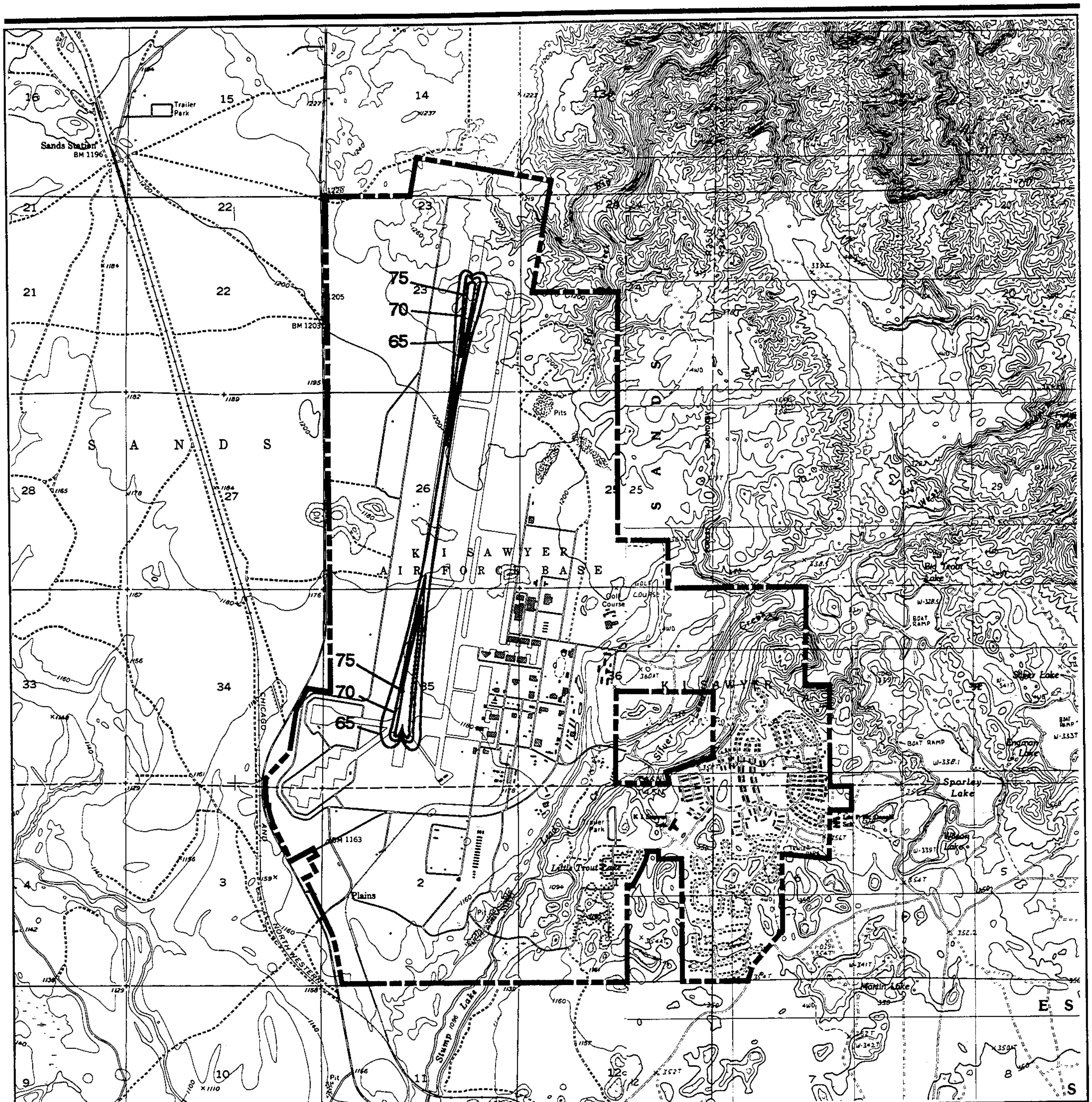
—— 65 —— DNL Noise Contours (5 dB intervals)

Day-Night Average Sound Level Commercial Aviation Alternative (2005)

0 1000 2000 4000 Feet

Source: U.S.G.S. 7.5 min.
Harvey, MI 1985, Little Lake, MI 1985,
Sands, MI 1975, Gwinn, MI 1975

Figure 4.4-11



EXPLANATION

— — — — Base Boundary

—— 65 —— DNL Noise Contours (5 dB intervals)

Day-Night Average Sound Level Commercial Aviation Alternative (2015)

0 1000 2000 4000 Feet

Source: U.S.G.S. 7.5 min.
Harvey, MI 1985, Little Lake, MI 1985,
Sands, MI 1975, Gwinn, MI 1975

Figure 4.4-12

Table 4.4-13. Distance to DNL from Roadway Center and Number of People - Commercial Aviation Alternative

Year	Roadway	Segment	Distance (feet) DNL 65 dB	Number of Residents	Distance (feet) DNL 70 dB	Number of Residents	Distance (feet) DNL 75 dB	Number of Residents
2000	CR 462	Main Gate to CR 553	40	0	20	0	(a)	NA
	CR 460	Gate 2 to CR 545	30	0	(a)	NA	(a)	NA
	CR 460	CR 545 to U.S. 41	30	0	20	0	(a)	NA
	CR 480	West of CR 553	100	0	50	0	20	0
	CR 480	CR 553 to U.S. 41	70	17	40	6	20	0
	CR 553	Marquette city limits to CR 480	90	3	40	0	20	0
	CR 553	CR 480 to CR 462	100	67	50	0	30	0
	CR 553	CR 462 to Southgate Drive	100	0	50	0	30	0
	CR 553	Southgate Drive to SH 35	70	0	40	0	20	0
	CR 545	U.S. 41 to CR 460	20	0	(a)	NA	(a)	NA
	CR 545	CR 460 to CR 456	(a)	NA	(a)	NA	(a)	NA
	CR 456	SH 35 to CR 545	40	30	20	0	(a)	NA
	CR 456	CR 545 to U.S. 41	20	0	(a)	NA	(a)	NA
	U.S. 41	SH 28 to Skandia	120	201	60	14	30	3
	U.S. 41	Skandia to SH 94	90	3	40	0	20	0
	U.S. 41	SH 94 to CR 456	60	0	30	0	(a)	NA
	SH 35	CR 553 to CR 456	50	6	30	0	(a)	NA
	SH 35	CR 456 to Morbit Lake Access	20	0	(a)	NA	(a)	NA
2005	CR 462	Main Gate to CR 553	50	0	30	0	(a)	NA
	CR 460	Gate 2 to CR 545	40	0	20	0	(a)	NA
	CR 460	CR 545 to U.S. 41	40	0	20	0	(a)	NA
	CR 480	West of CR 553	110	0	50	0	30	0
	CR 480	CR 553 to U.S. 41	80	39	40	6	20	0
	CR 553	Marquette city limits to CR 480	110	8	50	0	30	0
	CR 553	CR 480 to CR 462	130	89	60	11	30	0
	CR 553	CR 462 to Southgate Drive	120	0	60	0	30	0
	CR 553	Southgate Drive to SH 35	90	0	40	0	20	0
	CR 545	U.S. 41 to CR 460	30	6	10	0	(a)	NA
	CR 545	CR 460 to CR 456	20	0	(a)	NA	(a)	NA
	CR 456	SH 35 to CR 545	50	8	30	3	10	0
	CR 456	CR 545 to U.S. 41	30	0	10	0	(a)	NA
	U.S. 41	SH 28 to Skandia	130	220	60	14	30	3
	U.S. 41	Skandia to SH 94	100	6	50	0	30	0
	U.S. 41	SH 94 to CR 456	70	0	30	0	20	0
	SH 35	CR 553 to CR 456	60	11	30	0	20	0
	SH 35	CR 456 to Morbit Lake Access	30	0	20	0	(a)	NA
2015	CR 462	Main Gate to CR 553	70	0	30	0	20	0
	CR 460	Gate 2 to CR 545	60	0	30	0	(a)	NA
	CR 460	CR 545 to U.S. 41	60	0	30	0	(a)	NA
	CR 480	West of CR 553	140	8	70	0	30	0
	CR 480	CR 553 to U.S. 41	110	89	50	6	30	0
	CR 553	Marquette city limits to CR 480	150	11	70	3	30	0
	CR 553	CR 480 to CR 462	170	81	80	33	40	0
	CR 553	CR 462 to Southgate Drive	170	0	80	0	40	0
	CR 553	Southgate Drive to SH 35	110	0	50	0	30	0
	CR 545	U.S. 41 to CR 460	30	3	20	0	(a)	NA
	CR 545	CR 460 to CR 456	20	0	(a)	NA	(a)	NA
	CR 456	SH 35 to CR 545	70	14	30	3	20	0
	CR 456	CR 545 to U.S. 41	40	0	20	0	(a)	NA
	U.S. 41	SH 28 to Skandia	170	262	80	75	40	3
	U.S. 41	Skandia to SH 94	130	6	60	0	30	0
	U.S. 41	SH 94 to CR 456	90	0	40	0	20	0
	SH 35	CR 553 to CR 456	90	39	40	0	20	0
	SH 35	CR 456 to Morbit Lake Access	40	0	20	0	(a)	NA

Note: (a) Contained within the roadway.
CR = County Road
dB = decibel
DNL = day-night average sound level
NA = not applicable
SH = State Highway
U.S.# = U.S. Highway

4.4.4.4 Recreation Alternative. For this alternative, there would be no airport activity and, therefore, no aircraft noise impacts.

Surface traffic sound levels are presented by representative year in Table 4.4-14. These levels are presented in terms of DNL as a function of distance from the centerline of the roadways analyzed. There would be an estimated 563 people residing in areas exposed to DNL 65 dB or greater due to surface traffic by 2015. This would be an increase of 39 people over the No-Action Alternative.

Mitigation Measures. Mitigation measures for surface traffic noise would be the same as those described for the Proposed Action.

4.4.4.5 No-Action Alternative. There would be no airport activity and minimal surface traffic under the No-Action Alternative; therefore, there would be fewer noise impacts than anticipated for the other alternatives.

Surface traffic sound levels are presented in Table 4.4-15. These levels are presented in terms of DNL as a function of the centerline of the roadways analyzed. In 2000, approximately 236 people would reside within areas exposed to DNL 65 dB and above. This number would increase to 524 by 2015.

4.4.4.6 Other Land Use Concepts. Potential impacts resulting from increased noise levels from implementation of the other land use concepts are described below.

Michigan National Guard. No noise impacts are expected to occur from implementation of the MANG land use concept in conjunction with any alternative.

Correctional Institution. No noise impacts are expected to occur from implementation of the correctional institution independent land use concept in conjunction with any alternative.

Sawmill. With this concept there is the potential for increased noise levels from the use of equipment (e.g., planers, saws, chippers). Noise levels from the equipment could reach 115 A-weighted dB at the source. Because the Weapons Storage Area is approximately 0.6 mile from the residential area and the equipment would be used within a structure that can attenuate noise levels by approximately 20 dB, no noise sensitive receptors would be affected. Because the use of trains at K. I. Sawyer AFB for this concept would be on a spur line where speeds would be slow and the spur line is not near any residential areas, no sensitive receptors would be affected.

Table 4.4-14. Distance to DNL from Roadway Center and Number of People - Recreation Alternative

Year	Roadway	Segment	Distance (feet) DNL 65 dB	Number of Residents	Distance (feet) DNL 70 dB	Number of Residents	Distance (feet) DNL 75 dB	Number of Residents
2000	CR 462	Main Gate to CR 553	20	0	(a)	NA	(a)	NA
	CR 460	Gate 2 to CR 545	(a)	NA	(a)	NA	(a)	NA
	CR 460	CR 545 to U.S. 41	30	0	(a)	NA	(a)	NA
	CR 480	West of CR 553	90	0	40	0	20	0
	CR 480	CR 553 to U.S. 41	70	17	40	6	20	0
	CR 553	Marquette city limits to CR 480	90	3	40	0	20	0
	CR 553	CR 480 to CR 462	90	53	40	0	20	0
	CR 553	CR 462 to Southgate Drive	80	0	40	0	20	0
	CR 553	Southgate Drive to SH 35	70	0	30	0	(a)	NA
	CR 545	U.S. 41 to CR 460	20	0	(a)	NA	(a)	NA
	CR 545	CR 460 to CR 456	(a)	NA	(a)	NA	(a)	NA
	CR 456	SH 35 to CR 545	40	30	20	0	(a)	NA
	CR 456	CR 545 to U.S. 41	20	0	(a)	NA	(a)	NA
	U.S. 41	SH 28 to Skandia	110	165	50	6	30	3
	U.S. 41	Skandia to SH 94	80	0	40	0	20	0
	U.S. 41	SH 94 to CR 456	60	0	30	0	(a)	NA
	SH 35	CR 553 to CR 456	40	0	20	0	(a)	NA
	SH 35	CR 456 to Morbit Lake Access	20	0	(a)	NA	(a)	NA
2005	CR 462	Main Gate to CR 553	20	0	(a)	NA	(a)	NA
	CR 460	Gate 2 to CR 545	(a)	NA	(a)	NA	(a)	NA
	CR 460	CR 545 to U.S. 41	40	0	20	0	(a)	NA
	CR 480	West of CR 553	100	0	50	0	30	0
	CR 480	CR 553 to U.S. 41	80	39	40	6	20	0
	CR 553	Marquette city limits to CR 480	100	3	50	0	20	0
	CR 553	CR 480 to CR 462	100	67	50	0	30	0
	CR 553	CR 462 to Southgate Drive	100	0	50	0	20	0
	CR 553	Southgate Drive to SH 35	70	0	40	0	20	0
	CR 545	U.S. 41 to CR 460	20	0	(a)	NA	(a)	NA
	CR 545	CR 460 to CR 456	(a)	NA	(a)	NA	(a)	NA
	CR 456	SH 35 to CR 545	40	30	20	0	(a)	NA
	CR 456	CR 545 to U.S. 41	20	0	(a)	NA	(a)	NA
	U.S. 41	SH 28 to Skandia	130	220	60	14	30	3
	U.S. 41	Skandia to SH 94	100	6	50	0	20	0
	U.S. 41	SH 94 to CR 456	70	0	30	0	(a)	NA
	SH 35	CR 553 to CR 456	50	6	30	0	(a)	NA
	SH 35	CR 456 to Morbit Lake Access	30	0	(a)	NA	(a)	NA
2015	CR 462	Main Gate to CR 553	30	0	(a)	NA	(a)	NA
	CR 460	Gate 2 to CR 545	20	0	(a)	NA	(a)	NA
	CR 460	CR 545 to U.S. 41	50	0	20	0	(a)	NA
	CR 480	West of CR 553	130	8	60	0	30	0
	CR 480	CR 553 to U.S. 41	100	61	50	6	30	0
	CR 553	Marquette city limits to CR 480	130	11	60	3	30	0
	CR 553	CR 480 to CR 462	130	89	60	11	30	0
	CR 553	CR 462 to Southgate Drive	130	0	60	0	30	0
	CR 553	Southgate Drive to SH 35	100	0	50	0	20	0
	CR 545	U.S. 41 to CR 460	30	6	10	0	(a)	NA
	CR 545	CR 460 to CR 456	(a)	NA	(a)	NA	(a)	NA
	CR 456	SH 35 to CR 545	60	8	30	3	10	0
	CR 456	CR 545 to U.S. 41	30	0	10	0	(a)	NA
	U.S. 41	SH 28 to Skandia	170	262	80	75	40	3
	U.S. 41	Skandia to SH 94	120	6	60	0	30	0
	U.S. 41	SH 94 to CR 456	80	0	40	0	20	0
	SH 35	CR 553 to CR 456	70	11	30	0	20	0
	SH 35	CR 456 to Morbit Lake Access	40	0	20	0	(a)	NA

Note: (a) Contained within the roadway.
CR = County Road
dB = decibel
DNL = day-night average sound level
NA = not applicable
SH = State Highway
U.S.# = U.S. Highway

Table 4.4-15. Distance to DNL from Roadway Center and Number of People - No-Action Alternative

Year	Roadway	Segment	Distance (feet) DNL 65 dB	Number of Residents	Distance (feet) DNL 70 dB	Number of Residents	Distance (feet) DNL 75 dB	Number of Residents
2000	CR 462	Main Gate to CR 553	(a)	NA	(a)	NA	(a)	NA
	CR 460	Gate 2 to CR 545	(a)	NA	(a)	NA	(a)	NA
	CR 460	CR 545 to U.S. 41	30	0	(a)	NA	(a)	NA
	CR 480	West of CR 553	90	0	40	0	20	0
	CR 480	CR 553 to U.S. 41	70	17	40	6	20	0
	CR 553	Marquette city limits to CR 480	80	3	40	0	20	0
	CR 553	CR 480 to CR 462	80	33	40	0	20	0
	CR 553	CR 462 to Southgate Drive	80	0	40	0	20	0
	CR 553	Southgate Drive to SH 35	60	0	30	0	(a)	NA
	CR 545	U.S. 41 to CR 460	20	0	(a)	NA	(a)	NA
	CR 545	CR 460 to CR 456	(a)	NA	(a)	NA	(a)	NA
	CR 456	SH 35 to CR 545	40	3	20	0	(a)	NA
	CR 456	CR 545 to U.S. 41	20	0	(a)	NA	(a)	NA
	U.S. 41	SH 28 to Skandia	110	165	50	6	30	3
	U.S. 41	Skandia to SH 94	80	0	40	0	20	0
	U.S. 41	SH 94 to CR 456	60	0	30	0	(a)	NA
	SH 35	CR 553 to CR 456	40	0	20	0	(a)	NA
	SH 35	CR 456 to Morbit Lake Access	20	0	(a)	NA	(a)	NA
2005	CR 462	Main Gate to CR 553	(a)	NA	(a)	NA	(a)	NA
	CR 460	Gate 2 to CR 545	(a)	NA	(a)	NA	(a)	NA
	CR 460	CR 545 to U.S. 41	30	0	(a)	NA	(a)	NA
	CR 480	West of CR 553	100	0	50	0	30	0
	CR 480	CR 553 to U.S. 41	80	39	40	6	20	0
	CR 553	Marquette city limits to CR 480	90	3	50	0	20	0
	CR 553	CR 480 to CR 462	90	53	40	0	20	0
	CR 553	CR 462 to Southgate Drive	90	0	40	0	20	0
	CR 553	Southgate Drive to SH 35	70	0	40	0	20	0
	CR 545	U.S. 41 to CR 460	20	0	(a)	NA	(a)	NA
	CR 545	CR 460 to CR 456	(a)	NA	(a)	NA	(a)	NA
	CR 456	SH 35 to CR 545	40	3	20	0	(a)	NA
	CR 456	CR 545 to U.S. 41	20	0	(a)	NA	(a)	NA
	U.S. 41	SH 28 to Skandia	130	220	60	14	30	3
	U.S. 41	Skandia to SH 94	90	3	50	0	20	0
	U.S. 41	SH 94 to CR 456	70	0	30	0	(a)	NA
	SH 35	CR 553 to CR 456	40	0	20	0	(a)	NA
	SH 35	CR 456 to Morbit Lake Access	30	0	(a)	NA	(a)	NA
2015	CR 462	Main Gate to CR 553	(a)	NA	(a)	NA	(a)	NA
	CR 460	Gate 2 to CR 545	(a)	NA	(a)	NA	(a)	NA
	CR 460	CR 545 to U.S. 41	40	0	20	0	(a)	NA
	CR 480	West of CR 553	130	8	60	0	30	0
	CR 480	CR 553 to U.S. 41	100	61	50	6	30	0
	CR 553	Marquette city limits to CR 480	120	8	60	3	30	0
	CR 553	CR 480 to CR 462	120	78	60	11	30	0
	CR 553	CR 462 to Southgate Drive	110	0	50	0	30	0
	CR 553	Southgate Drive to SH 35	90	0	40	0	20	0
	CR 545	U.S. 41 to CR 460	20	0	(a)	NA	(a)	NA
	CR 545	CR 460 to CR 456	(a)	NA	(a)	NA	(a)	NA
	CR 456	SH 35 to CR 545	50	8	30	3	10	0
	CR 456	CR 545 to U.S. 41	20	0	(a)	NA	(a)	NA
	U.S. 41	SH 28 to Skandia	160	243	80	75	40	3
	U.S. 41	Skandia to SH 94	120	6	60	0	30	0
	U.S. 41	SH 94 to CR 456	80	0	40	0	20	0
	SH 35	CR 553 to CR 456	60	11	30	0	(a)	NA
	SH 35	CR 456 to Morbit Lake Access	40	0	20	0	(a)	NA

Note: (a) Contained within the roadway.
CR = County Road
dB = decibel
DNL = day-night average sound level
NA = not applicable
SH = State Highway
U.S.# = U.S. Highway

Waste to Energy/Recycling. No noise impacts are expected to occur from implementation of the waste to energy/recycling land use concept in conjunction with any alternative.

Waste to Energy/Environmental Support Operations. No noise impacts are expected to occur from implementation of the waste to energy/ environmental support operations land use concept in conjunction with any alternative.

4.4.5 Biological Resources

The reuse alternatives (except the No-Action Alternative) could potentially affect biological resources through alteration or loss of vegetation and wildlife habitat. These impacts are described below for each alternative.

Assumptions used in analyzing the impacts of the alternatives include:

- All staging and other areas temporarily disturbed by construction, demolition, and renovation would be placed in previously disturbed areas (e.g., paved or cleared areas), to the fullest extent possible.

- Proportions of disturbance associated with each land use category were determined based on accepted land use planning concepts. Development within each parcel could occur at one or more designated locations anywhere within that category.

- At on-base locations in which timber harvest would occur, forest management would follow accepted practices, including reforestation by such methods as replanting or leaving seed trees or shelterwood.

4.4.5.1 Proposed Action. The Proposed Action would have minimal impacts on biological resources. An estimated 681 acres would be disturbed by construction, demolition, and renovation by 2015. Most of these activities would take place in areas that have previously been disturbed and do not support natural vegetation or wildlife. Biologically sensitive areas on base would remain largely intact.

Vegetation. The overall effect to vegetation quality and distribution on K. I. Sawyer AFB from the Proposed Action is expected to be minimal. Of the total number of acres to be disturbed, the majority (620 acres) would be for industrial land uses. These uses are proposed mainly in areas that are landscaped or where the vegetation (forest or grassland) has already been disturbed, such as the military family housing area. Some small areas of forest would likely be removed for aviation support, industrial development, and proposed access routes. Removal of these forested areas is not expected to adversely affect this resource because of the abundance of forest in the surrounding area. The proposed off-base access route would

follow an existing dirt road through a recently logged area. The road upgrade is not expected to adversely affect the vegetation along its route.

The grassland area west of the runway could be affected by the proposed industrial reuse. However, impacts to vegetation would be negligible because the area has been previously disturbed by being artificially maintained as grassland. Development associated with the educational and residential land uses would have a negligible effect on native vegetation because these areas are landscaped.

The continued use of lands around the ecologically sensitive Little Trout Lake and the Silver Lead Creek riparian area as recreational areas is not expected to require new development or land disturbance and would, therefore, have no effect on the vegetation including the fir clubmoss, James' monkey-flower (Michigan species of special concern), and the dry-mesic northern forest. Training activities associated with the MANG and U.S. Army Reserve would disturb vegetation along the dirt roads and open areas during equipment use. Potential impacts to the ponds west of the runway within the area proposed for reuse by the MANG and U.S. Army Reserve are discussed in Sensitive Habitats.

Wildlife. The overall effect to wildlife from the Proposed Action is expected to be minimal. Effects on wildlife would be from habitat loss, demolition and renovation activities, and operations. Demolition and renovation activities would have short-term effects on local wildlife in adjacent areas, causing wildlife intolerant of such disturbances to avoid the area. Noise, activity and lighting associated with the operation of the airport and/or industrial facilities would continue to discourage intolerant species. These effects, including noise impacts on wildlife, would be less than under preclosure conditions when the airfield was fully operational. The Silver Lead Creek riparian area offers high quality wildlife habitat and would be used for recreational purposes. Effects from this and other recreational uses (golf course, recreation facilities) on K. I. Sawyer AFB would be similar to conditions prior to base closure. The frigga fritillary butterfly would not be affected by continued use of the Little Trout Lake recreational area.

Species that would be immediately affected by a loss or alteration of landscaped areas and timber forests in the aviation support and industrial areas include those that are sedentary or have relatively small home ranges. Included are some nesting birds (chipping sparrow, house wren, and song sparrow), small mammals (eastern chipmunk, meadow vole, and deer mouse), amphibians (spring peeper), and reptiles (common garter snake). The loss of habitat would also affect wider-ranging species that forage in the less disturbed areas, such as raptors (red-tailed hawk and great-horned owl), white-tailed deer, and predatory animals (coyote and fox). The majority of these wildlife species are found on the base within the stands of mixed deciduous and jack pine forests. Impacts to wildlife species within these

forests would be minimal due to the abundance of suitable habitat adjacent to the base. Because of the low habitat value of landscaped areas, disturbance within these areas would result in minimal impact to wildlife.

Although the military family housing area provides poor quality habitat for wildlife, these areas can allow a low level of access for wildlife to other biologically important areas (i.e., Silver Lead Creek riparian area) on base. Conversion of residential areas to industrial uses in the southeastern portion of the base would reduce wildlife access to the riparian area. Noise associated with military training activities conducted by the MANG and U.S. Army Reserve would cause intolerant mobile species to avoid the area during equipment use; however, once activities are complete, these species would return.

Threatened and Endangered Species. No federally or state-listed threatened or endangered species are expected to be impacted by the Proposed Action. Little Trout Lake and Silver Lead Creek provide foraging habitat for bald eagles (federally and state-listed as threatened) and common loons (state species of special concern), but disturbance of these species is expected to be minimal. This is partly due to the continued recreational use of these areas, similar to preclosure conditions, and partly to the availability of other large areas of suitable foraging habitat near the base.

Similarly, disturbance of forested areas would remove possible foraging habitat for gray wolves and peregrine falcons (both federally and state-listed as endangered). Impacts to gray wolves would be negligible, since sighting of these animals on the base have not been recorded and there is a large amount of other suitable foraging habitat in nearby areas. Peregrine falcons, which may forage in the area, would be similarly unaffected because there are large amounts of available foraging area. The Kirtland's warbler (federally and state-listed as endangered) is not expected to be found on the base. Wetter portions of the base, mainly those within the Silver Lead Creek riparian area, would be left in their present state, where they could provide habitat for the narrow-leaved gentian (state-listed as threatened), frigga fritillary, fir clubmoss, and James' monkey-flower (state species of special concern).

Sensitive Habitats. On K. I. Sawyer AFB, sensitive habitats are associated with the wetlands. Wetlands can lose value through direct or indirect impacts. Direct impacts can result when land is initially developed and/or when wetlands are filled, dredged, or flooded. Wetlands can also be impacted indirectly, from disturbance on adjacent lands, causing chemical or sedimentary runoff, which can result in water quality degradation. Wildlife habitat, a beneficial value of wetlands, can become fragmented by disturbance adjacent to wetland areas.

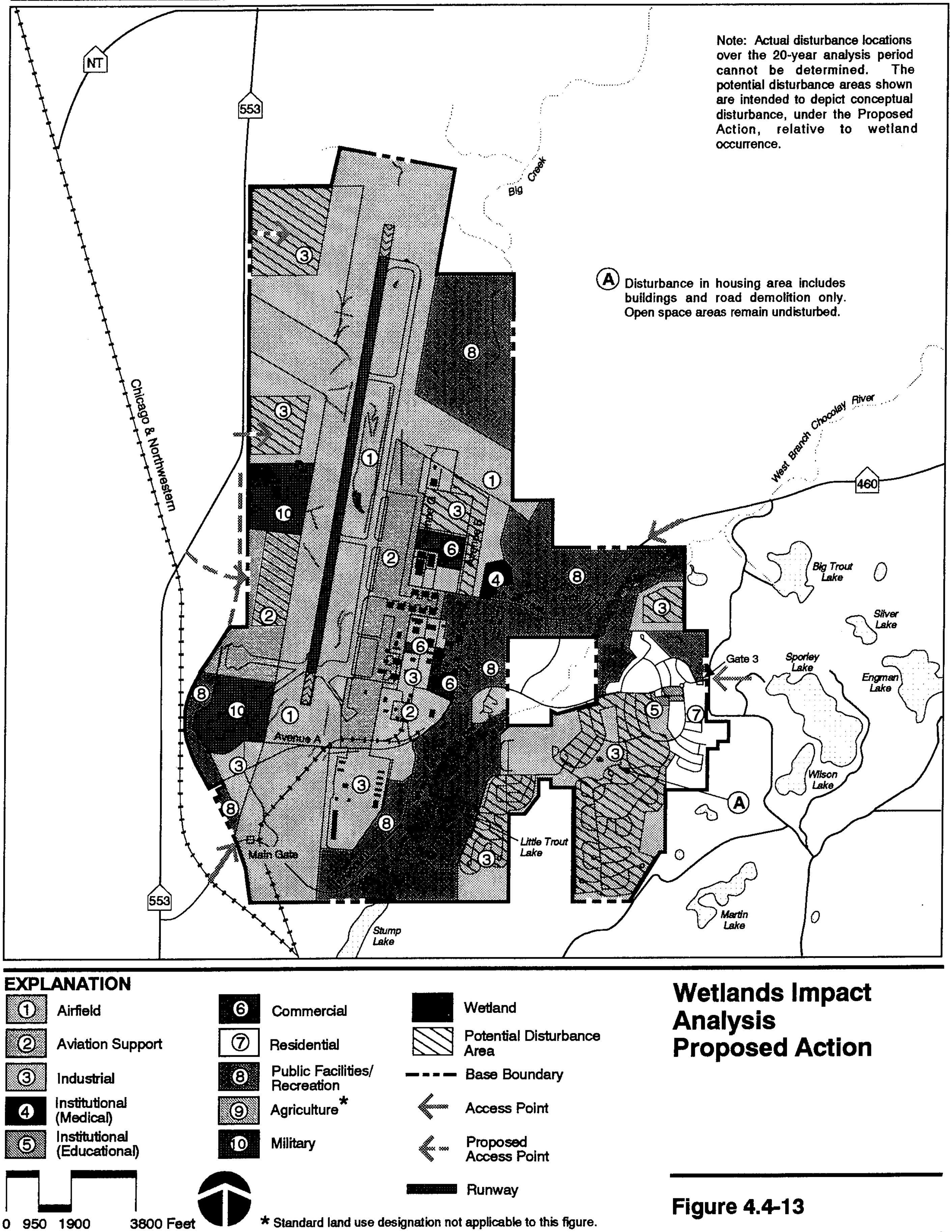
Table 4.4-16 shows the direct, on-site impacts anticipated at K. I. Sawyer AFB as a result of implementation of the Proposed Action. A total of 117 acres of wetlands are known to exist at K. I. Sawyer AFB, and if all 681 acres of disturbance were to occur with no regard to avoiding wetlands, 2.5 acres of wetlands could be affected. However, the Proposed Action does not include disturbance acreage that would exceed the upland acreage available for development on base. Table 4.4-16 illustrates that upland (non-wetland) acreage is available for any anticipated development under the Proposed Action. The table provides, within each land use category, the total number of acres, the number of wetland acres, and the amount of disturbance that could occur over the 20-year planning period. By subtracting the amount of wetland acreage from the total acreage of each land use parcel, the total amount of non-wetland acreage is determined. For example, a total of 1,483 acres are found within the industrial land use category. This category contains 2 acres of wetlands and 1,481 acres of non-wetlands. These 1,481 non-wetland acres would be available to allow the 620 acres of disturbance that would occur within this land use under the Proposed Action. Furthermore, construction or other activities in wetlands generally require engineering and siting considerations not required for upland disturbance. These considerations include potential for flooding and the presence of organic soils, which exhibit poor engineering properties. For these reasons, it is anticipated that few on-site wetlands would be directly impacted under the Proposed Action.

Table 4.4-16. On-Site Wetlands, Direct Impacts - Proposed Action

Land Use	Total Acres	Wetland Acres	Disturbed Acres[a]	Non-Wetland Acres[b]	Likely Wetland Impact
Airfield	1,397	5.5	0	1,391.5	0
Aviation support	455	0.5	56	454.5	0
Industrial	1,483	2	620	1,481	0
Institutional	24	0	1	24	0
Commercial	43	0	0	43	0
Residential	152	0	4	152	0
Public facilities/recreation	1,183	104	0	1,079	0
Military	186	5	0	181	0
Total	4,923	117	681	4,806	0

Notes: (a) Potentially developed or disturbed acreage.
(b) Upland areas within which potential development could occur.

Figure 4.4-13 further illustrates the practicality of avoidance to prevent disturbance or development of wetlands at K. I. Sawyer AFB. The disturbance areas shown on the figure are conceptual only; they are not



Wetlands Impact Analysis Proposed Action

Figure 4.4-13

intended to illustrate where actual disturbance would occur under the Proposed Action. Rather, they are intended to show that wetlands could be avoided if full build-out of the Proposed Action were to occur. Although disturbance or development is anticipated to occur at both existing developed and undeveloped sites at K. I. Sawyer AFB, disturbance is illustrated here only at locations that do not currently have buildings at the base, except in the military family housing area, which, under the Proposed Action, would be demolished for industrial development. Figure 4.4-13 shows that all development proposed within each land use category under the Proposed Action for the 20-year analysis period could reasonably occur without directly impacting wetlands. The figure also illustrates that ample non-wetland areas exist to provide buffers around the wetlands to avoid indirect impacts as well.

Under this alternative, there would be no new construction within the recreation areas around Little Trout Lake and the Silver Lead Creek riparian area (approximately 104 acres of wetlands including the bogs). Effects from recreational uses of this area would be limited and similar to preclosure conditions.

Mitigation Measures. The Air Force has specific responsibilities for the disposal of wetlands at K. I. Sawyer AFB. Section 4 of Executive Order 11990 states that when federally owned wetlands are leased or disposed of to nonfederal or private parties, the federal agency shall (a) reference in the conveyance these uses that are restricted under identified federal, state, or local wetlands regulations; and (b) attach other appropriate restrictions to the uses of the property by the grantee or purchaser and any successor, except where prohibited by law ; or (c) withhold such properties from disposal. Implementation of these laws and orders, as described below, will provide protection for these valuable wetland resources.

Additionally, reuse activities affecting wetlands would be subject to Michigan's Goemaere-Anderson Wetlands Protection Act (Act No. 203). A permit from MDNR's Land and Water Management Division would be required for regulated activities, which include placing fill, dredging, construction, or draining water from wetlands. The permit would specify any mitigations required to offset potential impacts. Any additional coordination with the COE regarding Section 4 of the Clean Water Act would be conducted through the MDNR permitting process. Agency-recommended mitigations would take into account the size and quality of the wetlands involved. Mitigations for wetland impacts could include (1) avoidance of direct and indirect disturbance of wetlands through facility redesign or appropriate restrictions in the transfer documents; (2) on-base (if possible) replacement of any wetlands lost at a ratio determined through consultation with the MDNR and COE; (3) restoration/enhancement of wetland habitat elsewhere on the base or purchase and fencing of any off-base replacement habitat; and (4) monitoring (until habitat becomes well

established) of any replacement wetlands as required to determine the effectiveness of replacement and any remedial measures. Avoidance of impacts, where practicable, represents the lowest cost mitigation and can be accomplished in a shorter time frame than wetland replacement. Because the creation or development of wetlands represents a substantial financial investment, and the process may take several years to complete, this option is often reserved for wetland mitigation of high quality or for a sizable area of affected wetlands. The probability of success that the newly created wetland would survive and flourish could also vary, which sometimes makes this option less desirable than wetland restoration or avoidance. The primary property recipient could implement this mitigation through its contractors, the MDNR/COE through their permitting process, or the Air Force through lease/deed restrictions.

Avoiding disturbance to the wetlands could include controlling runoff from construction sites into the wetland through use of berms, silt curtains, straw bales, and other appropriate techniques. Equipment should be washed in areas where wastewater can be contained and treated or evaporated.

Additionally, the Michigan Soil Erosion and Sedimentation Control Act (Act No. 347) requires permits for earth changes that disturb 1 acre or more of land within 500 feet of a lake or stream, or for alterations in the stream excluding plowing, tilling, mining, and logging. A soil erosion and sedimentation control plan is also required.

Executive Order 11990 directs the Air Force to provide references to restrictions existing in law and regulations, attach restrictions, or withhold disposal of wetlands on fee-owned property. If the Proposed Action were implemented, the Air Force would reference in the conveyance documents those uses that are restricted under federal and state wetlands regulations, including those regulated by the Clean Water Act and the Michigan Goemaere-Anderson Wetlands Protection Act. This reference would be made in accordance with the provisions of Section 4 of Executive Order 11990. The Air Force could impose land use restrictions, conservation easements, and other mitigation measures, as appropriate, to comply with Executive Order 11990.

Such restrictions could include conservation easements or deed restrictions for wetlands which might allow for public enjoyment and wildlife usage, while protecting wetlands from development. Conservation easements would be managed by responsible agencies, such as the USFWS, MDNR, or other entities that would maintain and monitor the wetland areas. Deed restrictions would place the responsibility for protection of wetlands under the management of property recipients. These easements and/or restrictions would help to minimize potential direct and indirect wetland impacts. Further, pursuant to the Executive Order, the Air Force will consider the

option of withholding fee-owned property containing wetlands from disposal.

Avoidance of wetlands is the environmentally preferred mitigation. Pursuant to Executive Order 11990, avoidance could be achieved by imposing land use restrictions, conservation easements, and other mitigation measures, as appropriate, in a manner that protects the wetlands. To the extent practicable, wetlands would be managed for conservation purposes. Potential developers/reusers of K. I. Sawyer AFB property should confirm any identified boundaries (through delineation) prior to the onset of any construction activities. They should also contact the MDNR in Marquette early in the planning process to avoid development delays.

4.4.5.2 International Wayport Alternative. The International Wayport Alternative would have minimal impacts on biological resources. An estimated 380 acres would be disturbed by construction, demolition, and renovation by 2015. Most of the disturbance would be in areas that do not support natural vegetation or wildlife. Biologically sensitive areas on base would remain largely intact.

Vegetation. Most of the 380 acres of vegetation that would be disturbed for this alternative are low quality habitat (e.g., landscaping or disturbed grassland). Some small stands of forest east and west of the runway and some larger stands south of the runway would likely be removed for airfield, aviation, and industrial development. Removal of the forests is not expected to adversely affect this resource, due to the abundance of forest in the surrounding area. Impacts from development of the off-base access route would be similar to those described for the Proposed Action.

The area designated for agriculture is primarily forest, stands of which have been cut periodically and are in varying stages of regrowth. Impacts associated with timber harvesting would be the same as preclosure conditions. Timber sales on state-owned land, approximately 75 percent of the agricultural land use, would be evaluated by MDNR. This process includes taking an inventory of the area to be harvested and public review of the harvest prior to the timber sale. Timber harvesting on state-owned land would follow MDNR silviculture management practices. Property transferred to private interest is not regulated by MDNR for timber harvesting, but must comply with regulations for the protection of wetlands and prevention of increased soil erosion.

The continued use of lands around Little Trout Lake and Silver Lead Creek as recreational areas is not expected to require new development or land disturbance and would, therefore, have no effect on the vegetation, including the fir clubmoss, James' monkey-flower, and dry-mesic northern forest. Potential impacts to the ponds west of the runway within the agricultural land use area are discussed below under Sensitive Habitats.

Wildlife. Effects on wildlife from habitat loss, demolition activities, and operations would be similar to those described for the Proposed Action, except that under the International Wayport Alternative parcels of land near the runway would be designated as agriculture and the residential areas in the southeastern part of the base would not be converted to industrial uses. Although timber harvesting would be expected to occur in the parcels of land near the runway at least once during the 20-year analysis period, timber forests can provide some moderate-quality habitat for wildlife. Impacts to wildlife would be minimal due to the abundance of these habitat types in the area and the continued use of existing forest management practices (including reforestation). Effects from recreational use (hiking and camping) on site would be similar to preclosure conditions. Silver Lead Creek and Little Trout Lake riparian areas would be preserved in their present state which would be beneficial to the frigga fritillary butterfly. Effects from airfield activities, including noise impacts on wildlife, would be similar to preclosure conditions when the airfield was fully operational.

Threatened and Endangered Species. No federally or state-listed threatened or endangered species are expected to be impacted by the International Wayport Alternative. Effects on sensitive species in the area would be similar to those described for the Proposed Action.

Sensitive Habitats. Impacts to sensitive habitats would be similar to those described for the Proposed Action, except the maximum potential impacts to wetlands under this alternative would include 8.5 acres. However, as with the Proposed Action, anticipated impacts to wetlands under this alternative are minimal except for the 2 acres that would be impacted for construction of the crosswind runway. The specific requirements for the crosswind runway would require direct impact to 2 acres of wetlands. These wetlands consist of low quality, disturbed areas consisting of drainage ditches and small depressions, created during the construction of the existing runway, and are maintained by activities such as mowing.

Table 4.4-17 shows the direct, on-site impacts anticipated at K. I. Sawyer AFB as a result of implementation of the International Wayport Alternative. The table reveals that ample upland area is available within each land use for development. For example, within the aviation support land use area, 616.5 acres of non-wetland area would be available to absorb the 74 acres of disturbance that would occur within this land use under this alternative.

Figure 4.4-14 further illustrates the practicality of avoidance to prevent disturbance or development of wetlands at K. I. Sawyer AFB. As with the Proposed Action, the areas shown on the figure are conceptual only; they are not intended to illustrate where actual disturbance would occur under the International Wayport Alternative. Rather, they are intended to show that wetlands could be avoided if full build-out of this alternative were to occur. Disturbance or development is anticipated to occur at both existing

Table 4.4-17. On-Site Wetlands, Direct Impacts - International Wayport Alternative

Land Use	Total Acres	Wetland Acres	Disturbed Acres[a]	Non-Wetland Acres[b]	Likely Wetland Impact
Airfield	1,055	5	94[c]	1050	2
Aviation support	617	0.5	74	616.5	0
Industrial	495	0.5	121	494.5	0
Institutional	162	2	0	160	0
Commercial	64	0	3	64	0
Residential	538	0.5	0	537.5	0
Public facilities/recreation	1,118	103	0	1,015	0
Agriculture	874	5.5	88	868.5	0
Total	4,923	117	380	4,806	2

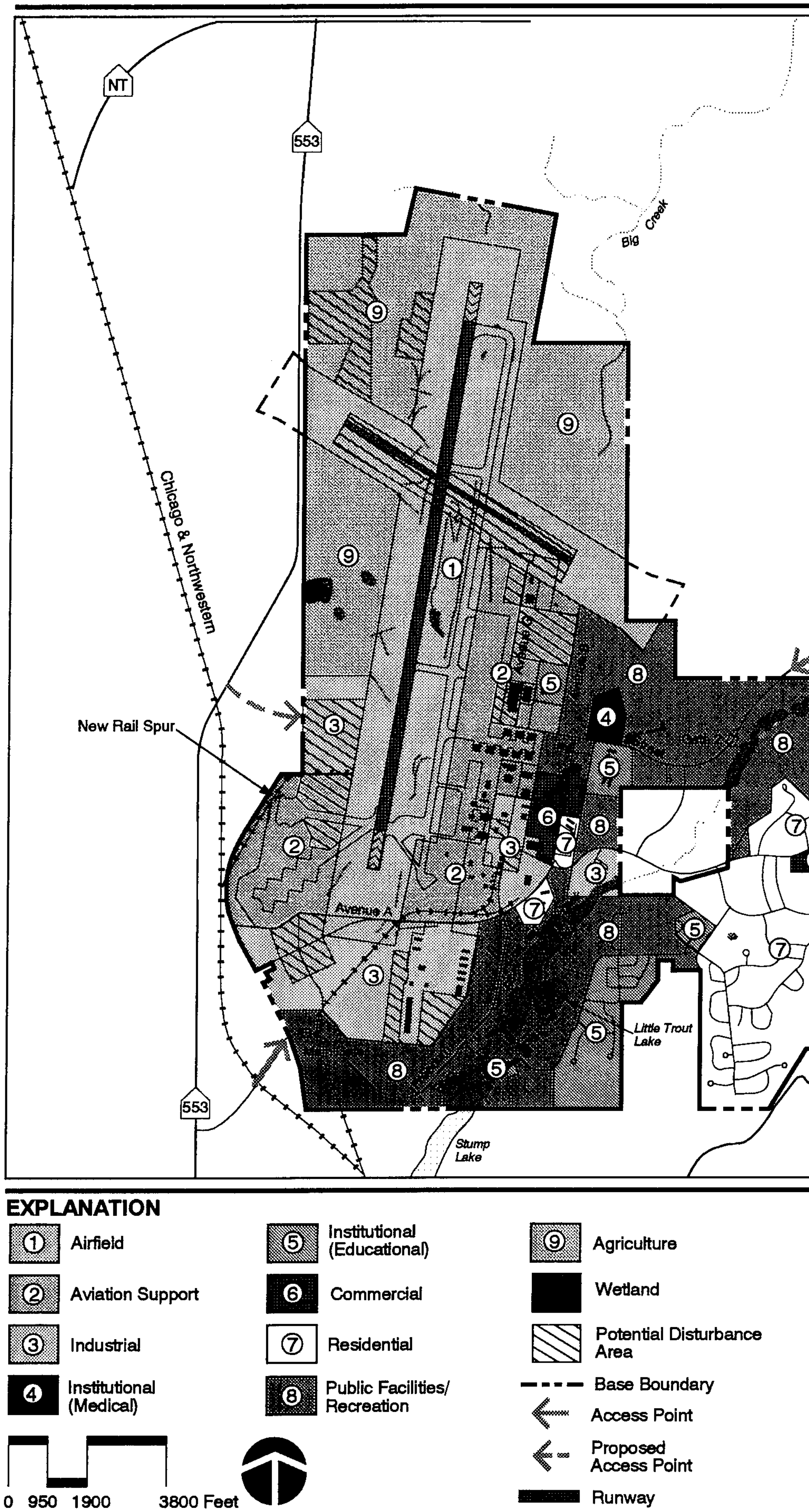
Notes: (a) Potentially developed or disturbed acreage.
(b) Upland areas within which potential development could occur.
(c) The 94 acres of disturbance for this land use is for the construction of the crosswind runway. Only 2 acres of wetlands exist within this area.

developed and undeveloped sites at K. I. Sawyer AFB. Figure 4.4-14 shows that all development proposed within each land use category under the International Wayport Alternative could reasonably occur without directly impacting wetlands, except for the construction of the crosswind runway.

Under this alternative, there would be no new construction within the recreation areas around the Little Trout Lake and the Silver Lead Creek riparian area. Effects from recreational uses of this area would be limited and similar to preclosure conditions.

Mitigation Measures. Mitigation measures, the responsible parties, and effectiveness of the mitigation under the International Wayport Alternative would be the same as those described for the Proposed Action. Construction of the crosswind runway would impact wetlands in the central part of the base. These wetlands are man-made and continually disturbed during runway maintenance activities, making them low quality. Because the total acres of anticipated affected wetland is low, restoration, enhancement, or preservation of other wetlands in the area may be the preferred mitigation options.

During timber activities, timber on steep slopes adjacent to the ponds on the west side of the runway should not be harvested. Following the recommendations of the Escanaba River State Forest Comprehensive Resource Management Plan during timber harvesting would further reduce siltation into the ponds. Recommendations in the plan that have been found to be most effective in reducing soil erosion in water bodies include maintaining a band of natural vegetation, 150 feet wide, on each side of and



Wetlands Impact Analysis International Waypoint Alternative

Figure 4.4-14

parallel to the water resource (Michigan Department of Natural Resources, 1991). Timber harvesting activities could comply with MDNR silviculture management practices.

4.4.5.3 Commercial Aviation Alternative. The Commercial Aviation Alternative would have minimal impacts to biological resources. A total of 259 acres would be disturbed by 2015, but most of the disturbance would be concentrated in areas that are developed or altered.

Vegetation. Impacts to vegetation under this alternative would be negligible because most ground disturbance for the aviation support, industrial, institutional, and commercial development would occur in areas that are landscaped or contain buildings. Impacts from public facilities/recreation and agriculture would be the same as for the International Wayport Alternative, except that there would be a beneficial impact of open space as the result of some military family housing demolition on the east side of the base. This area would be expected to naturally revegetate beginning with grasses and forbs, then shrubs, and eventually a pine-hardwood-aspen forest. The agricultural areas encompassing the northern end of the existing runway would be reforested. Construction of industrial facilities may result in the removal of some forests, which have been cut periodically in the past and are abundant in the vicinity of K. I. Sawyer AFB. As discussed under the International Wayport Alternative, forest on state-owned land would be managed by MDNR; forest on private land is not regulated, but must comply with other environmental regulations.

Wildlife. Effects on wildlife under the Commercial Aviation Alternative would be similar to those of the Proposed Action except that additional parcels of land would be designated as public facilities/recreation and agriculture, and the noise disturbances associated with airfield activities would be reduced. Both of these changes would result in beneficial impacts to wildlife on base. Disturbances to wildlife due to demolition and renovation would be temporary and would create beneficial impacts in the long term with the conversion of landscaped areas to natural habitat. New timber forests would provide some moderate-quality habitat for wildlife. Impacts to wildlife species would be minimal if existing forest management practices (including reforestation) are continued.

Threatened and Endangered Species. No federally or state-listed threatened or endangered species would be impacted by the Commercial Aviation Alternative. The Silver Lead Creek riparian area, which provides quality habitat for the bald eagle, common loon, narrow-leaved gentian, fir clubmoss, James' monkey-flower, and frigga fritillary butterfly, would be preserved in its present state.

Sensitive Habitats. The types of impacts to sensitive habitats would be similar to those described for the Proposed Action. The maximum potential

impacts to wetlands under this alternative would include 9.5 acres. However, as with the Proposed Action, anticipated impacts to wetlands under this alternative are minimal. Table 4.4-18 shows the direct, on-site impacts anticipated at K. I. Sawyer AFB as a result of implementation of the Commercial Aviation Alternative. The table reveals that ample upland area is available within each land use for development. For example, within the industrial land use area, 493 acres of non-wetland area would be available to absorb the 29 acres of disturbance that would occur within this land use under this alternative.

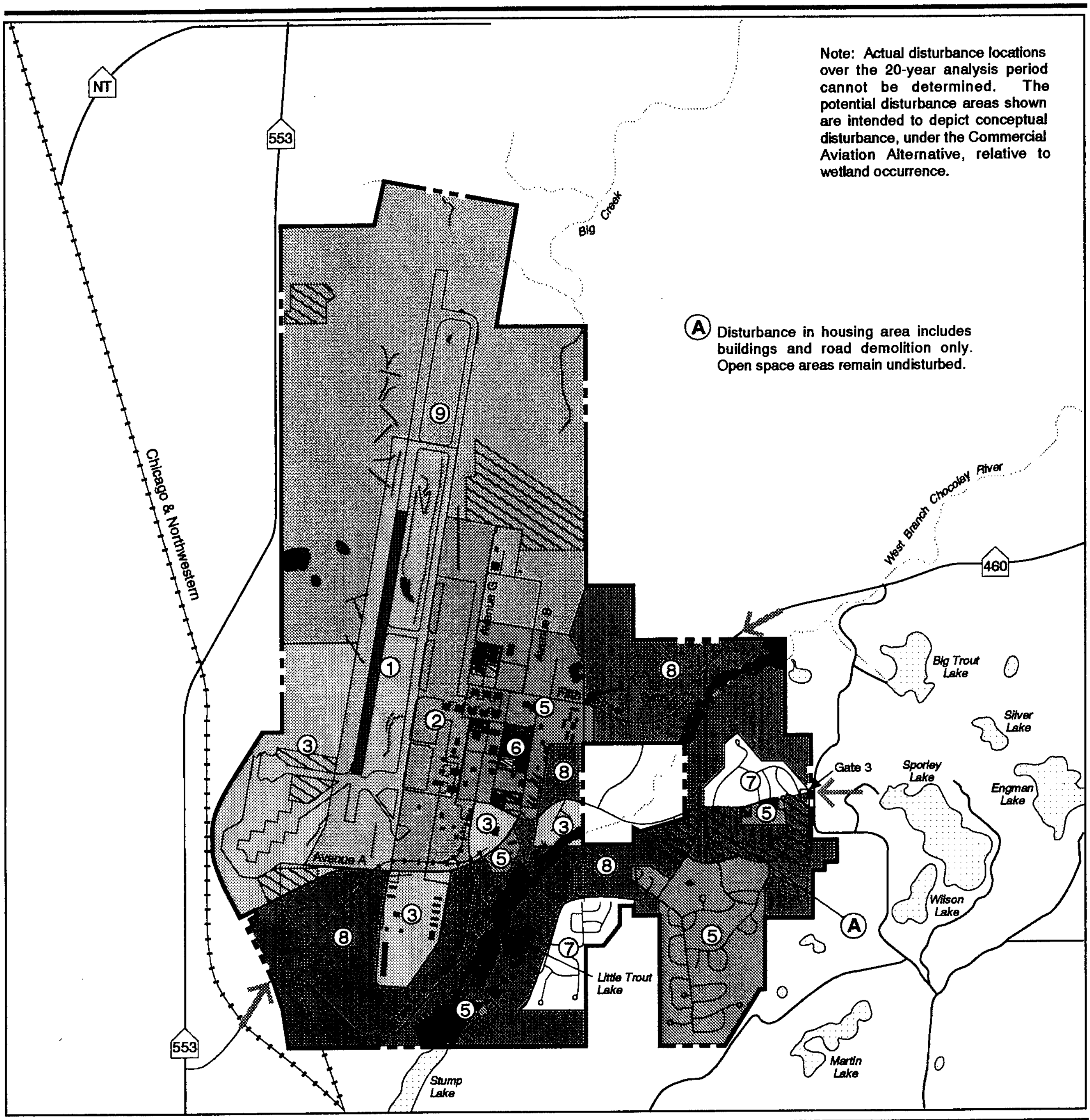
Table 4.4-18. On-Site Wetlands, Direct Impacts - Commercial Aviation Alternative

Land Use	Total Acres	Wetland Acres	Disturbed Acres[a]	Non-Wetland Acres[b]	Likely Wetland Impact
Airfield	510	3.5	0	506.5	0
Aviation support	325	0.5	9	324.5	0
Industrial	494	1	29	493	0
Institutional	546	2.5	11	543.5	0
Commercial	25	0	1	25	0
Residential	147	0	0	147	0
Public facilities/recreation	1,387	104	61[c]	1,283	0
Agriculture	1,489	5.5	148	1,483.5	0
Total	4,923	117	259	4,806	0

Notes: (a) Potentially developed or disturbed acreage.
(b) Upland areas within which potential development could occur.
(c) Disturbed acres for demolition of the military family housing units. No wetlands exist within the proposed demolition area.

Figure 4.4-15 further illustrates the practicality of avoidance to prevent disturbance or development of wetlands at K. I. Sawyer AFB. As with the Proposed Action, the areas shown on the figure are conceptual only; they are not intended to illustrate where actual disturbance would occur under the Commercial Aviation Alternative. Rather, they are intended to show that wetlands could be avoided if full build-out of this alternative were to occur. Disturbance or development is anticipated to occur at both existing developed and undeveloped sites at K. I. Sawyer AFB. Figure 4.4-15 shows that all development proposed within each land use category under the Commercial Aviation Alternative could reasonably occur without directly impacting wetlands.

Under this alternative, there would be no new construction within the recreation areas around Little Trout Lake and the Silver Lead Creek riparian area. Effects from recreational uses of this area would be limited and similar to preclosure conditions.



EXPLANATION

- ① Airfield
- ② Aviation Support
- ③ Industrial
- ④ Institutional (Medical) *
- ⑤ Institutional (Educational)
- ⑥ Commercial
- ⑦ Residential
- ⑧ Public Facilities/ Recreation
- ⑨ Agriculture
- Wetland
- Potential Disturbance Area
- Base Boundary
- Access Point
- Runway

0 950 1900 3800 Feet

* Standard land use designation not applicable to this figure.

Wetlands Impact Analysis Commercial Aviation Alternative

Figure 4.4-15

Mitigation Measures. Mitigation measures, the responsible parties, and effectiveness of the mitigation under the Commercial Aviation Alternative would be the same as those described for the Proposed Action. In addition, timber on steep slopes adjacent to the ponds on the west side of the runway should not be harvested. Following the recommendations of the Escanaba River State Forest Comprehensive Resource Management Plan during timber harvesting would further reduce siltation into the ponds. Recommendations in the plan that have been found to be most effective in reducing soil erosion in water bodies include maintaining a band of natural vegetation, 150 feet wide, on each side of and parallel to the water resource (Michigan Department of Natural Resources, 1991). Timber harvesting activities could comply with MDNR silviculture management practices.

4.4.5.4 Recreation Alternative. The Recreation Alternative could have an overall positive impact on biological resources. Over 80 percent of the base would be set aside for public open space and recreation uses. Ground disturbance of 201 acres under this alternative would be largely limited to the existing main base and housing areas.

Vegetation. Impacts to the vegetation associated within the public facilities/ recreation land use areas would be largely beneficial. Disturbances associated with other facilities would have no impact on vegetation, with the possible exception of industrial expansion.

Industrial facilities may impact some small stands of forest on the west side of the base and could impact some small drainages associated with the runway. Impacts to the forest would not be adverse due to the small size and low quality of the stand to be removed and the abundance of this forest type in the surrounding area.

Replanting with native vegetation and decreases in maintenance (e.g., mowing) of areas designated for public facilities/recreation would allow them to gradually return to a native condition. Most disturbances would be the demolition of facilities in the military family housing and industrial areas, which would have no effect on the vegetation because these areas lack native vegetation. These areas would be replanted with native vegetation, and over the long term, reuse would be a beneficial impact to vegetation.

Uses associated with public facilities/recreation would be concentrated during the winter, causing minimal or no impacts to vegetation. However, some features, such as cross-country skiing trails, may be constructed. Vegetation removal for narrow paths through most forested areas would not be significant if pathways do not impact wetlands.

Wildlife. Effects of habitat alteration, including demolition activities and operations, would be similar to those of the Commercial Aviation Alternative, except there would be no aircraft operations under this

alternative. Most construction-related disturbances under this alternative would be from industrial and institutional development, would be short-term, and would be in areas that have been previously disturbed or provide minimal habitat value. The area designated for recreational uses (approximately 80 percent of the base) would be revegetated and/or managed to encourage native vegetation establishment, especially in the Silver Lead Creek riparian area. Effects from recreational uses (e.g., hiking, cross-country skiing, and snowmobiling) would be similar to preclosure conditions except for potential disturbances due to clearing of trails. Impacts to wildlife species from trail clearing and other recreational activities would be negligible. Overall, long-term effects on wildlife and wildlife habitat under this alternative would be beneficial.

Threatened and Endangered Species. No federally or state-listed threatened or endangered species are expected to be impacted by the Recreation Alternative. With the additional open space and preservation of quality wildlife habitat, impacts to sensitive wildlife species under this alternative would be considered beneficial.

Sensitive Habitats. Impacts to sensitive habitats would be similar to those described for the Proposed Action; the maximum potential impacts to wetlands under this alternative would include 2.5 acres. However, as with the Proposed Action, anticipated impacts to wetlands under this alternative are minimal. Table 4.4-19 shows the direct, on-site impacts anticipated at K. I. Sawyer AFB as a result of implementation of the Recreation Alternative. The table reveals that ample upland area is available within each land use for development. For example, within the industrial land use area, 795 acres of non-wetland area would be available to absorb the 7 acres of disturbance that would occur within this land use under this alternative.

Table 4.4-19. On-Site Wetlands, Direct Impacts - Recreation Alternative

Land Use	Total Acres	Wetland Acres	Disturbed Acres[a]	Non-Wetland Acres[b]	Likely Wetland Impact
Industrial	797	2	7	795	0
Institutional	67	0	3	67	0
Commercial	13	0	1	13	0
Residential	60	0	0	60	0
Public facilities/recreation	3,986	115	190[c]	3,871	0
Total	4,923	117	201	4,806	0

Notes: (a) Potentially developed or disturbed acreage.
(b) Upland areas within which potential development could occur.
(c) Disturbed acres for the demolition of the military family housing. Only 0.5 acres of wetlands exist within the proposed demolition area. This wetland area can be avoided during housing demolition.

Figure 4.4-16 further illustrates the practicality of avoidance to prevent disturbance or development of wetlands at K. I. Sawyer AFB. As with the Proposed Action, the areas shown on the figure are conceptual only; they are not intended to illustrate where actual disturbance would occur under the Recreation Alternative. Rather, they are intended to show that wetlands could be avoided if full build-out of this alternative were to occur. Disturbance or development is anticipated to occur at both existing developed and undeveloped sites at K. I. Sawyer AFB. Figure 4.4-16 shows that all development proposed within each land use category under the Recreation Alternative could reasonably occur without directly impacting wetlands.

Under this alternative, there would be no new construction within the recreation areas around Little Trout Lake and the Silver Lead Creek riparian area. Effects from recreational uses of this area would be limited and similar to preclosure conditions.

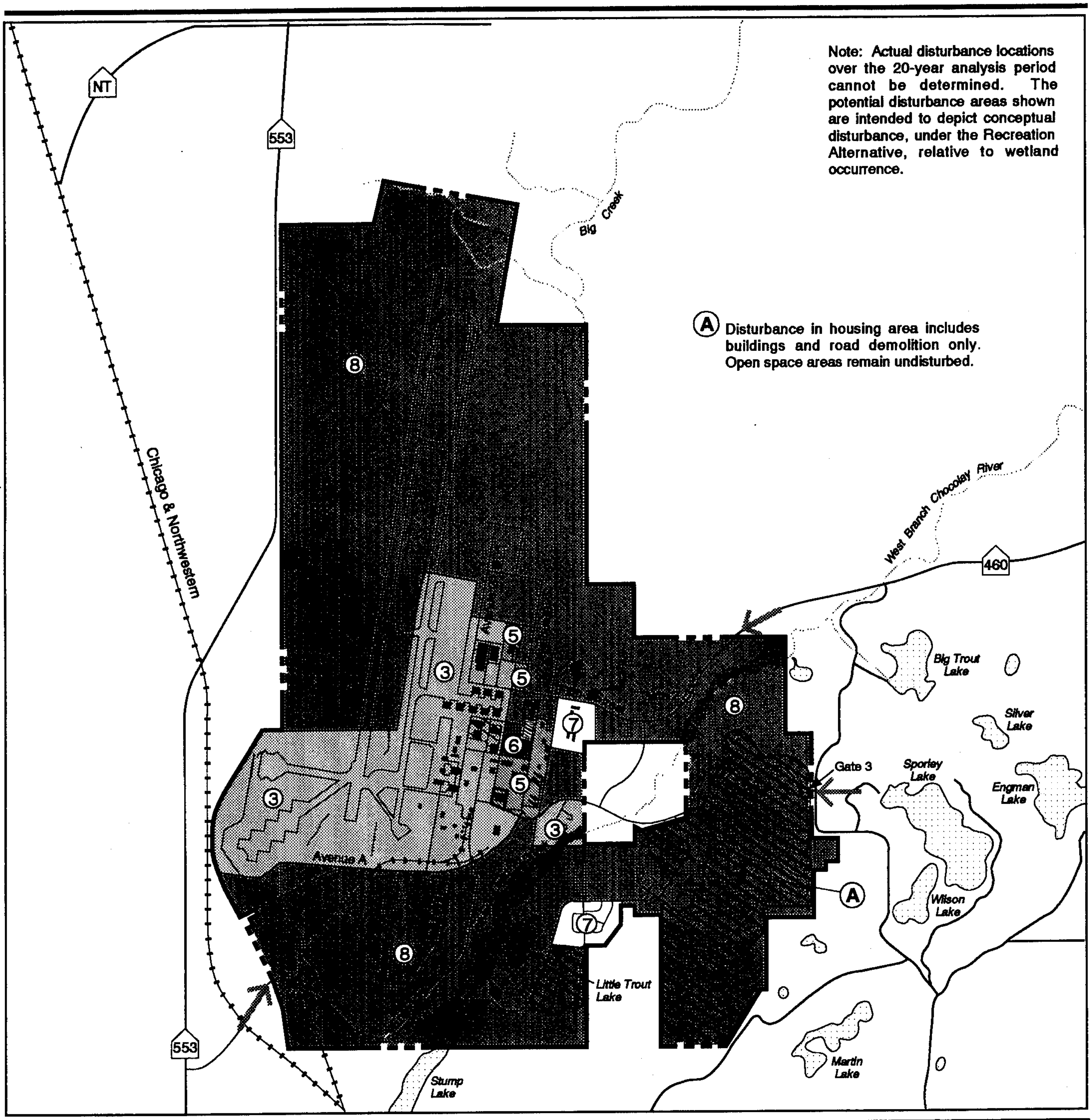
Mitigation Measures. Mitigation measures would be similar to those described for the Proposed Action. Placement of any new trails or other recreational features should avoid wetlands where practicable.

4.4.5.5 No-Action Alternative. Maintenance of the base under the No-Action Alternative would have minimal adverse effects on biological resources. A reduction in human activity and a cessation of aircraft flights would reduce disturbance to wildlife on and in the vicinity of the base. Habitat quality for wildlife could improve if mowing of non-landscaped areas was discontinued, thereby allowing vegetation to grow to a height that would benefit wildlife species.

4.4.5.6 Other Land Use Concepts. Effects on biological resources as a result of the other land use concepts that may be implemented are described below.

Michigan Army National Guard. The area proposed for use by the MANG contains approximately 5 acres of wetlands that may be utilized for driver training of heavy equipment. Potential impacts to the wetlands could occur if equipment is used in or near the wetlands. However, there is sufficient training area to avoid the wetlands. No threatened or endangered species would be affected by this land use concept.

Correctional Institution. The correctional institution would be sited in an area comprising mostly disturbed forested land, although an area in the northeast corner of the proposed site is undisturbed forest. The eastern boundary of the site would be adjacent to drainage ditches west of the runway. Vegetation losses are assumed to be 161 acres as a result of blading and leveling of the land within the fenced facility. Impacts to vegetation and wildlife in the forested areas would be similar to those



EXPLANATION

① Airfield *	⑤ Institutional (Educational)	⑨ Agriculture *
② Aviation Support *	⑥ Commercial	Wetland
③ Industrial	⑦ Residential	Potential Disturbance Area
④ Institutional (Medical) *	⑧ Public Facilities/ Recreation	Base Boundary
		Access Point

0 950 1900 3800 Feet

* Standard land use designation not applicable to this figure.

Wetlands Impact Analysis Recreation Alternative

Figure 4.4-16

discussed under the Proposed Action. Construction activities could remove drainage ditch habitat (wetlands) along the eastern edge of the site, and mitigation measures for the wetlands would be the same as those described for the Proposed Action. No threatened or endangered species would be affected by construction of the correctional institution.

Sawmill. The proposed sawmill site on K. I. Sawyer AFB would be located in previously disturbed grassland and existing buildings. Because of the unnatural state of the vegetation in the area and the availability of this habitat nearby, and because the wildlife associated with this habitat is common and has a high tolerance with human presence, reuse of the area as a sawmill is expected to cause only minimal impacts to vegetation and wildlife. Small, low quality drainage ditch wetlands (one in the northwest portion of the project area alongside the roadway and rail spur, and one parallel to and just outside of the eastern boundary of the proposed sawmill location) could be influenced by the sawmill facilities and activities. Impacts to these wetlands could occur if equipment is used in or near these areas, or if contaminated surface water or erosion runoff is allowed to flow into them. Use of equipment away from wetland areas and proper management of potential contaminants and erosion should preclude these impacts. Therefore, negligible impacts are expected from the sawmill land use concept. There are no threatened or endangered species that would be affected by this land use concept.

Waste to Energy/Recycling. The proposed locations for use by the waste to energy/recycling operation would be in landscaped areas. Reuse of the facilities is not expected to adversely affect vegetation or wildlife, since these buildings are sited in existing developed areas. Construction of the processing unit would also be within developed areas. No threatened or endangered species or sensitive habitats would be affected by this land use concept.

Waste to Energy/Environmental Support Operations. The proposed locations for use by the waste to energy/environmental support operations operation would be in landscaped areas. Reuse of the facilities is not expected to adversely affect vegetation or wildlife, since these buildings are sited in developed areas. Construction or modification of facilities would also be within developed areas. No threatened or endangered species or sensitive habitats would be affected by this land use concept.

4.4.6 Cultural Resources

Potential impacts were assessed by (1) identifying types and possible locations of reuse activities that could directly or indirectly affect cultural resources, and (2) identifying the nature and potential significance of cultural resources in potentially affected areas. Pursuant to the NHPA, consultation,

as directed by the Section 106 review process, has been initiated with the Michigan SHPO.

Historic properties under 36 CFR Part 800 are defined as any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the NRHP. This term includes, for the purposes of these regulations, artifacts, records, and remains that are related to and located within such properties. The term "eligible for inclusion in the National Register" includes both properties formally determined as such by the Secretary of the Interior and all other properties that meet NRHP-listing criteria. Therefore, sites not yet evaluated are considered potentially eligible to the NRHP and, as such, are afforded the same regulatory consideration as nominated historic properties.

As a federal agency, the Air Force is responsible for identifying any historic properties at K. I. Sawyer AFB. This identification process includes not only field surveys and recording of cultural resources, but also evaluations to develop determinations of significance in terms of NRHP criteria. NRHP criteria and related qualities of significance are discussed in Appendix E. Completion of this process results in a listing of historic properties subject to federal regulations regarding the treatment of cultural resources.

The identification process, as defined by the NHPA, is ongoing at K. I. Sawyer AFB. During the Phase I investigation, three prehistoric sites (29MQ89, 20MQ90, and 20MQ91) and two historic sites (20MQ93 and 20MQ94) were identified at K. I. Sawyer AFB as potentially eligible for listing in the NRHP (Commonwealth Cultural Resources Group, 1994b). A Phase II investigation was recommended and in coordination with the Michigan SHPO was implemented to evaluate the significance of these five sites. Because they were found to lack integrity, the two historic sites were determined to be not eligible for inclusion in the NRHP. Prehistoric site 20MQ89 also was determined to be not eligible because of low artifact density and the lack of diagnostic artifacts and subsurface features. However, substantial numbers of artifacts and intact subsurface features were identified at prehistoric sites 20MQ90 and 20MQ91. Both sites were determined to be significant under Criterion D for listing in the NRHP because they have the potential to address a number of research questions important to understanding the prehistory of the interior headwaters regions of the Upper Peninsula (Commonwealth Cultural Resources Group, 1994b). The Michigan SHPO has concurred with these determinations.

The historic buildings and structures inventory and evaluation at K. I. Sawyer AFB did not identify any facilities considered eligible for listing in the NRHP. SHPO concurrence on the determination has been received.

Regulations for implementing Section 106 of the NHPA indicate that the conveyance of an historic property from federal land without adequate measures to ensure preservation is procedurally considered to be an adverse impact, thereby ensuring full regulatory consideration in federal project planning and execution. All confirmed and potential historic properties on base could be impacted by conveyance.

4.4.6.1 Proposed Action. Under the Proposed Action, a number of reuse activities could impact the two prehistoric sites considered potentially eligible for listing in the NRHP. The prehistoric sites are in an area proposed to be utilized for public facilities/recreation uses. The sites (20MQ90 and 20MQ91) are near existing public facilities that include a picnic ground, a beach/play area, a campground, and a park. No ground-disturbing activities (e.g., demolition or new facility construction) are planned for the public facilities/recreation area, but these sites could be indirectly impacted under this alternative by looting or vandalism and soil erosion through public use of the area. Both prehistoric sites are on Air Force fee-owned property and could be impacted by conveyance to a nonfederal entity.

Mitigation Measures. Under 36 CFR Part 800.9(b), transfer, lease, or sale of federal lands containing historic properties is considered an adverse effect. Therefore, the disposal and reuse of K. I. Sawyer AFB has the potential to create an adverse effect on cultural resources. However, an exception (36 CFR Part 800 9[c]) to this criteria of adverse effect is the application of "adequate restrictions or conditions...to ensure preservation of the property's significant historic features which would effectively reduce impacts resulting from disposal to a non-adverse level." If 20MQ90 and 20MQ91, which are on Air Force fee-owned land are conveyed to a nonfederal entity, adverse effects can be reduced to a nonadverse level through the use of preservation covenants developed in coordination with the Air Force and SHPO. These stipulations could be included in deed restrictions on the disposal document. Listed below are some suggested stipulations that could be included within the preservation covenants.

Management options available to subsequent recipients of 20MQ90 and 20MQ91 include preservation in place and data recovery. Because it is the Air Force's goal to preserve archaeological sites in place and avoid disturbance whenever feasible, preservation in place is the preferred option.

Further work that could be required of property recipients has been identified for site 20MQ90. The site is on a low terrace that is actively eroding along the southern and western edges. It is recommended that a monitoring program be established to periodically assess the site condition. In the event that site integrity appears threatened or compromised, subsequent management options (e.g., stabilization, data recovery) would be developed and implemented by the property owners to preserve the site integrity in consultation with SHPO.

If at any time during the disposal process preservation in place ensured by preservation covenants proves to be infeasible, the Air Force would develop an alternative management strategy in coordination with SHPO. Specific mitigations would, if necessary, be set forth in a Memorandum of Agreement between the Air Force, SHPO, the Advisory Council on Historic Preservation, and other interested parties.

4.4.6.2 International Wayport Alternative. Under this alternative impacts to the two prehistoric sites would be the same as for the Proposed Action.

Mitigation Measures. Appropriate mitigation measures would be the same as those outlined for the Proposed Action.

4.4.6.3 Commercial Aviation Alternative. Impacts to the prehistoric sites under this alternative would be identical to those discussed for the Proposed Action.

Mitigation Measures. Appropriate mitigation measures would be the same as those outlined for the Proposed Action.

4.4.6.4 Recreation Alternative. Under this alternative impacts to the two prehistoric sites would be the same as for the Proposed Action.

Mitigation Measures. Appropriate mitigation measures would be the same as those outlined for the Proposed Action.

4.4.6.5 No-Action Alternative. No effect on cultural resources on the two archaeological sites within Air Force fee-owned property would result from implementation of the No-Action Alternative, because this portion of K. I. Sawyer AFB will remain under federal jurisdiction. The OL would continue to ensure adequate security to deter illegal activities, such as looting of the archaeological sites, as specified in the Archaeological Resources Protection Act.

4.4.6.6 Other Land Use Concepts. Effects on cultural resources as a result of the other land use concepts that may be implemented are described below.

Michigan Army National Guard. Because none of the identified historic properties are within the areas identified for this independent land use concept, no impacts would occur.

Correctional Institution. Because none of the identified historic properties are within the area proposed for the correctional institution, no impacts would occur.

Sawmill. Because none of the identified historic properties are within the areas identified for this independent land use concept, no impacts would occur.

Waste to Energy/Recycling. Because none of the identified historic properties are within the areas identified for this independent land use concept, no impacts would occur.

Waste to Energy/Environmental Support Operations. Because none of the identified historic properties are within the areas identified for this independent land use concept, no impacts would occur.

4.5 SUMMARY OF ENVIRONMENTAL CONSEQUENCES OF REUSE OF MARQUETTE COUNTY AIRPORT

The Proposed Action, International Wayport Alternative, and Commercial Aviation Alternative assume relocation of aircraft operations from Marquette County Airport to K. I. Sawyer AFB. With K. I. Sawyer AFB serving as a regional airport, the Marquette area would not need a second airport at the existing Marquette County Airport site.

No definite plans for the closure and reuse of Marquette County Airport have been developed by the K. I. Sawyer Base Conversion Authority or any other local agency. Based on conversations with local officials and airport representatives, it was assumed that the airport could be developed for a combination of industrial, institutional (education and government), commercial, residential, and public facilities/recreation uses. A final decision on the actual reuse of the airport would be made by the local community and the FAA. The effects of relocating aircraft operations and airport-related activities based at Marquette County Airport to K. I. Sawyer AFB have been factored into the Proposed Action, International Wayport Alternative, and Commercial Aviation Alternative. Potential effects from reuse of Marquette County Airport in Negaunee Township as a non-aviation-related facility are outlined below. Impacts are described for the same resource categories as discussed in this EIS for the Proposed Action, International Wayport Alternative, and Commercial Aviation Alternative.

Community Setting. Reuse activities associated with the industrial, institutional (education and government), commercial, residential, and public facilities/recreation development at Marquette County Airport is expected to generate new jobs in the Negaunee and Marquette areas and could potentially increase local population.

Land Use and Aesthetics. Closure and reuse of the Marquette County Airport would require an update to the Negaunee Township Comprehensive Plan to reflect proposed uses. Depending upon the final development selected, the Township would need to ensure that the proposed land uses

are consistent with zoning for the airport property. The types of uses assumed to occur with reuse of the airport are generally compatible with the surrounding existing industrial, commercial, residential, and forested lands. Development of the airport could change the aesthetic qualities of the wetland and forested areas on the property and within the surrounding areas.

Transportation. Reuse activities from Marquette County Airport property could increase traffic on U.S. 41 to levels similar to those when the airport was operational if the site is completely developed over 20 years. If reuse of the airport includes residential development, there is potential for the LOS on U.S. 41 to degrade from the current LOS C. The LOS D on SH 35 at the intersection with U.S. 41 should not be affected by reuse of the airport. Traffic on other local roads surrounding the airport may also increase depending on the traffic circulation required for the development of the airport property.

The reuse of Marquette County Airport as a non-aviation-related facility would not impact regional air transportation or airspace.

Utilities. Direct changes in future utility use at the site were based on historic per capita use at the Marquette County Airport and within Marquette County. The reuse activities could increase the water demand at the site to 0.07 MGD, wastewater generation to 0.06 MGD, electrical use to 14 MWH per day, solid waste generation to 3.2 tons, and natural gas consumption to 0.47 MMCF per day. However, all of the local utility purveyors have sufficient design capacities (see Sections 3.2.4 and 3.5) to meet the needs of reuse development at this site.

Hazardous Materials and Hazardous Waste Management. The hazardous materials likely to be used at the site is expected to be associated with industrial, institutional, commercial, residential, and public facilities/ recreation land uses. Hazardous wastes would be generated from the hazardous materials and processes that utilize these materials within each land use. Management of hazardous materials and hazardous waste in accordance with applicable regulations would preclude any unacceptable impacts.

Site investigations and/or site remediation of contaminated sites is expected to continue at the Marquette County Airport. Property disposal is expected to be delayed and reuse of some properties may be restricted by the extent and type of contamination at each site and by future remediation activities.

Storage tanks at the site that are not in compliance with state and federal regulations are expected to be removed and/or replaced in accordance with applicable regulations. Because of the construction date of some of the facilities at the airport, there is the potential for them to contain ACM and

lead-based paint. Any demolition or renovation of facilities at the airport should be monitored to minimize the potential risk to human health and the environment.

Natural Environment

Geology and Soils. Effects of reuse of the site on the regional geology and soils would be minimal, and would primarily result from ground disturbance associated with facility construction, renovation, demolition, and infrastructure improvement. These activities could alter the soil profiles and local topography.

Use of sand and gravel resources (e.g., for construction material and concrete) for new facilities and roadways would not be expected to reduce availability of these materials from local supplies. Because local soils are susceptible to wind erosion, short-term impacts from construction or renovation activities could occur. Ground-disturbing activities, demolition of existing facilities, removal of vegetative cover, and grading would increase the potential for wind erosion. However, once disturbed areas have been covered with pavement, buildings, facilities, or vegetation, susceptibility to erosion would be minimal. As part of the construction permitting process, a soil erosion control plan for disturbance greater than 1 acre would need to be prepared and submitted to the county for approval before construction can start. In addition, soil control measures describe in Section 4.4.1, Geology and Soils, could be utilized to further reduce the erosion potential.

Water Resources. With reuse of the site, soils could be compacted during facility construction, renovation, demolition, as well as during infrastructure improvements, and overlaid with asphalt, concrete, or buildings, creating impervious surfaces that would cause increased storm water runoff to local storm sewers and sewage systems. Storm water discharge (non-point source) from possible new development could degrade surface water resources within the airport property. However, as discussed in Section 4.4.2, Water Resources, measures could be implemented that would reduce the potential for storm water discharge.

Redevelopment of the site may also be subject to NPDES permit requirements for storm water discharges during the construction period and for the duration of operations. This provision is contained in the NPDES Permit Application Regulations for Storm Water Discharge issued by the U.S. EPA as a final rule on November 16, 1990.

Reuse of the site would have minimal adverse impacts to groundwater resources. On-site demand for water could be 0.07 MGD, which is within the well capacity of the Negaunee Township. Groundwater supplies and local wells in the vicinity of the airport would need to be monitored for the potential migration of contaminants from airport sites.

Air Quality. Air quality could be impacted by the reuse of Marquette County Airport due to the potential for pollutant emissions from reuse activities. For VOC, NO_x, and SO_x, per-employee emission factors calculated for industrial land uses in Marquette County are higher than those calculated for current conditions at the site; however, per-employee emission factors for CO are lower than calculated for current conditions due to the activity of high CO-emitting aircraft. Per-employee emission factors for PM_{10} are not available. Assuming reuse-related employment is similar to 1991 levels (408 employees), emissions of VOC, NO_x, and SO_x would increase; emissions of CO would decrease.

Stationary sources would be subject to the applicable federal and state new source review program for stationary sources. The reuse proponent would be required to determine the potential-to-emit for each new stationary source in the permit application process. Appropriate control technology, emissions monitoring, and reporting requirements would be specified in any air quality permits issued.

Noise. With the relocation of aircraft operations from Marquette County Airport, noise generated by airport-related activities would be eliminated. There may be some increase in noise levels along U.S. 41 from increased traffic related to reuse of the site.

Biological Resources. Because it would be expected that reuses at Marquette County Airport would be mostly in previously disturbed areas, development, demolition, or new construction impacts are expected to be minimal. Designation of some areas as recreation/open space would encourage regrowth of native vegetation and would benefit the vegetation communities.

Reusing existing airport buildings and limiting new construction to areas that are already disturbed would minimize impacts to wildlife and their habitats. Noise and activity from construction could temporarily displace songbirds and some small animals that are capable of relocating.

No impacts to threatened or endangered species are expected from the reuse of Marquette County Airport, since no listed species are known to be present at this time.

Development or disturbance of Marquette County Airport wetland areas requires a state and/or federal permit. The bog area north of the crosswind runway does not require a state permit, since it is not subject to the Goemaere-Anderson Wetland Protection Act, but would require a Section 404 Clean Water Act permit for dredge, fill, or flooding activities. Development in non-wetland areas and setting aside wetland areas as open space would minimize or avoid impacts. Erosion and sedimentation control measures to mitigate runoff into wetland areas from any future construction

activities (in accordance with Michigan Soil Erosion and Sedimentation Act) would minimize indirect effects to wetlands from nearby construction. Other mitigation measures, as described in Section 4.4.5, Biological Resources, could also be implemented.

Cultural Resources. Although the SHPO has determined no historic properties are present at Marquette County Airport, this determination does not preclude the possibility that historic properties could be discovered during future development or renovation. If this occurs, activities should be suspended and the SHPO should be contacted immediately.

4.6 SUMMARY OF ENVIRONMENTAL CONSEQUENCES OF TIMBER ACTIVITIES IN THE SAWMILL PROCUREMENT AREA

This section identifies the general impacts that could be expected to occur from timber harvesting activities for the proposed sawmill at K. I. Sawyer AFB to provide the decision maker with the necessary information about the potential for environmental consequences. Because many factors, such as price, quality of lumber, and location are taken into account to determine where each actual harvest would take place, it is too speculative to provide site-specific impacts and mitigation measures within the large procurement area. Since the exact location of the individual timber harvest has not yet been selected, the discussion of the environmental consequences is programmatic rather than site specific. A programmatic analysis identifies the general types of impacts that could occur from harvesting activities, rather than focusing on impacts at individual sites. Site-specific timber management for each harvest would be handled through the timber sales requirements enforced by each landowner. Any required mitigation measures to reduce impacts from harvesting activities would be enforced by each individual landowner as necessary. The direct environmental consequences of the sawmill operation at K. I. Sawyer AFB are addressed under each resource in Sections 4.2 through 4.4 as an other land use concept.

The major source of data used to assess the impacts of timber harvesting activities caused by the proposed sawmill at K. I. Sawyer AFB was the Final Generic Environmental Impact Statement Study on Timber Harvesting and Forest Management in Minnesota (Jaakko Poyry Consulting Inc., 1994). This EIS was determined by forestry officials in Wisconsin and Michigan to be a good source on the expected impacts from timber harvesting activities in a Great Lake State environment. Other sources used included U.S. Forest Service EISs, State Forest Management Plans, and guidebooks to forest and water resources BMPs from Wisconsin and Michigan.

As discussed in Section 3.6, harvesting activities would occur in the northern Lower Peninsula of Michigan, the Upper Peninsula of Michigan, and in northeast Wisconsin. The timber to be harvested would consist of

softwoods, including spruce, balsam, pine, hemlock, and tamarack. Timber harvesting activities on public land and its effects to the environment would be managed under either local, state, or federal guidelines. In addition, timber harvesting activities would have to adhere to environmental regulations (e.g., NHPA, Endangered Species Act) and BMPs, which would protect sensitive resources within the procurement area. Provided below is a brief description of the potential effects on timber availability and timber harvesting within the procurement area. Although it is expected that approximately 30 percent of the harvest may come from existing sources (Bertsch, 1995) (e.g., timber cut for another, less efficient mill), this analysis is based on the entire harvest associated with the proposed sawmill at K. I. Sawyer AFB coming from new sources.

For purposes of analysis, nearly 100 percent adherence to BMPs was anticipated on public lands and industrial private forest lands (Jaakko Poyry Consulting Inc., 1994). A lower level of adherence (about 92 percent) to BMPs is expected on private nonindustrial forest lands, which make up 40 percent of the acreage in the timbershed (George Banzhaf & Company, 1995b). This level of adherence is expected to improve over time, based on current educational and cooperative forestry programs that continue to be implemented at the federal, state, and local level.

Timber Resources. The results of the analysis conducted for the proposed sawmill at K. I. Sawyer AFB (George Banzhaf & Company, 1995b) concluded that the timber harvest could be increased within the procurement area to meet the needs of the proposed sawmill. The volume of softwoods in the area (except balsam fir and pine) is growing faster than it is being harvested. Because the inventory of balsam fir is overmature, declining in vigor, and constantly under stress by the spruce budworm, the growth rate is slow. The balsam fir inventory could be increased (in the long term) by more intensive management, resulting in higher harvest rates. This period of adjustment from an overmature to a managed resource would likely involve a temporary reduction in harvest levels as harvests are adjusted to optimize the resource for the long term.

The estimates of red pine and jack pine growth may understate the volume that could be harvested in the next several decades because of an age class imbalance, where much of the pine acreage is at a mid-rotation age, when thinning yields can be substantial. The analysis of plantation (planted trees) thinning and clearcut yields suggests that the red pine plantation resources should provide 30.0 million cubic feet per year in the 1996-2005 period, 35.0 million cubic feet per year in the 2006-2015 period, and 60.8 million cubic feet per year in the 2016-2025 period. Taking into consideration the thinning yields and specific age class distribution of the planted red pine, current harvest could be increased by 20 percent in the short term and as much as 80 percent in the longer term.

As discussed in Section 3.6, the net annual growth rate of the softwood species to be utilized by the proposed sawmill is 97 million cubic feet and the current estimated harvest within the procurement area is approximately 79 million cubic feet. Therefore, the proposed sawmill's estimated maximum requirement of 75 million board feet (6.4 million cubic feet) would utilize approximately 35 percent of the remaining annual growth of 18 million cubic feet. The assumed decline in pine harvest and increase in the harvest of other softwoods would result in a stable projected pine inventory and approximately a 20 percent increase in the inventory of other softwoods during the period from 1995 to 2015.

The actual amount of timber harvested would be based on economics and the demand for lumber. The sawmill at K. I. Sawyer AFB would harvest timber based on the actual demand for the lumber. It is likely that timber would be harvested by other sawmills within the region to meet any lumber demand even if the sawmill at K. I. Sawyer AFB is not established.

Other factors that apply to timber demand is waste wood (sawdust, bark, and chips) generated from the proposed sawmill. Some of this is typically used by the sawmill as boiler fuel, but some of the material would be provided to local pulp mills. These chips would be consumed directly by pulp mills which would otherwise have to purchase logs. The net effect of providing chips from the sawmill to the pulp mills would be to reduce the demand for timber harvesting to meet the needs of the pulp mills.

All timber harvesting and forest management activities affect forest health, and all have impacts. These can range from minimal to major. Given the changes that occur on a forest stand as a result of management activities, vulnerability to impacts is a function of the insect, disease or other health vector, potential for wildfire, the associated harvesting or management related disturbance, and the susceptibility of the forest to impact. Species composition would also be expected to change over time. The resultant tree species mix in the procurement area would be driven by the management decisions made by individual landowners. Thus, a diverse continuum of potential impacts exists.

Major consideration for impacts to forest health are insects, disease, and other health vectors (such as dwarf mistletoe), and wildfire. The silvicultural systems, site preparation methods, reforestation procedures (including choices in species composition), and site maintenance activities can all affect future forest health. These considerations can vary by site, forest cover type, and the management objectives of the individual land owner.

Implementation of BMPs and proper forest management planning are the key to reducing adverse forest health impacts. Based on a review of the major ownership classifications, and the owner's propensity for adherence to BMPs, it is expected that increased forest management activities in the

public forests would result in more intensive management of those areas, resulting in greater application of regulatory-mandated BMPs. Therefore, public forests would be less susceptible to impacts related to forest health.

On private industrial forests, BMPs are implemented through voluntary and market-based incentives. Essentially these lands are managed to protect the standing and future timber inventory. Because implementation of forest health BMPs is generally employed throughout industry, minimal negative impacts related to forest health are anticipated.

Of all the major ownership types, nonindustrial private forest lands would be most susceptible to forest health impacts of increased timber harvest in the procurement area. This conclusion is based on the lower overall rate of voluntary BMP adherence (about 92 percent), and the inclination of some owners to favor the short-term economic benefits of harvest over the longer term benefits of proper silvicultural practices. Without adequate consideration of ecological factors in planning timber harvests, the residual 8 percent of this ownership that does not implement BMPs can increase the potential for health vector success, and can contribute to fuels' buildup, which could increase the opportunity for ignition and spread of wildfire. Health vectors and wildfire could then spread to other public and private lands where BMPs are implemented, compounding management concerns in those areas.

Mitigation Measures

Continuation and expansion of programs encouraging voluntary implementation of BMPs (i.e., through education and tax incentives) would serve to preclude forest health impacts on nonindustrial private forest lands.

Land Use and Aesthetics. Under the proposed sawmill concept, the timber harvesting activities would increase the area to be harvested by 7,000 acres of land per year. Because most of the timber procurement area is managed for timber production, little or no change to land use would be expected.

Timber harvesting activities under the sawmill concept could impact the recreation opportunities in a variety of ways. Harvesting can affect the type of recreation opportunities available, the quality of the recreational experience, and the number of hours of recreational activities within a given site. Some of the impacts are related to the recreational user's visual perception and the attraction of the forest setting. Some impacts are long term while others are short term and/or subject to change from forest growth and dynamics on that site over a broader context of an area (Jaakko Poyry Consulting, Inc., 1993). Typically, clearcuts have a greater effect on recreational activities than thinning of the forest resource.

Timber harvesting activities within the procurement area could change or eliminate some primitive recreation opportunities (e.g., hiking) and create travel barriers, such as closed roads, especially while operations are ongoing. Timber harvesting activities typically do not occur in developed recreation areas so these areas should be relatively unaffected. Timber harvesting within the procurement area could also provide beneficial recreation effects, such as providing increased road access with the development of new roads, and may, in some cases, increase habitat for deer or grouse for hunters. In addition, conflicts between logging vehicles and recreational drivers for use of roadways could degrade the recreational experience (Jaakko Poyry Consulting, Inc., 1993). In most timber harvesting when the quality of the recreational experience was judged to decrease, activity hours were expected to increase based on more access. On federal and state land, recreational opportunities (including hunting) are managed for continued public enjoyment and are not usually affected by timber harvesting activities except for short periods of time. County and local ordinances for the maintenance of recreational opportunities can also apply to timber harvesting activities. Timber stands on private land have few developed recreational areas, and these lands are used mostly for hunting and winter activities such as snowmobiling.

Increased or inappropriate harvesting activities within the proposed timber procurement area could reduce the aesthetic experience for subsequent users, thereby limiting the recreational value of both harvested and adjacent unharvested areas. The overall aesthetic experience is dependent upon views of the landscape and the opportunity to be in a natural or relatively unmodified setting. Given the relatively flat topography, visually sensitive resources that could be affected are those next to lakes and rivers, important tourist and recreation areas, and along recognized tourist access routes. Of the different silviculture methods, clearcutting poses the greatest visual effect. With extensive clearcutting, the visual character of the forest area will change significantly from a continuous canopy with occasional openings to a broken canopy with frequent openings. Depending on the location, some breaks in the canopy may open up vistas and views. Strip cutting or block cutting could also introduce strong contrasts and unnatural shapes in the landscape. Forest practices, such as patch cuts and thinning, create few visual impacts. It is estimated that 4,300 acres or 62 percent of the timber to be harvested could come from clearcutting, the remainder from thinning.

Long-term visual impacts are not expected to occur on public lands (38 percent of the ownership) because of the implementation of formalized visual management systems which maintain the aesthetic quality near sensitive areas. There are no formalized systems in place for industrial and nonindustrial private forest (62 percent of ownership). Assuming the percentage of clearcutting acres would be uniform on public and private land, approximately 2,700 acres would not be managed for aesthetic

resources, except for protected areas, such as lake shorelines and designated natural and scenic areas.

Mitigation Measures

The following mitigation measures could be implemented to reduce timber harvesting effects on recreation and visual resources within the procurement area.

- Conduct timber harvest during the winter or during seasons when recreational use of the forest is low. In addition, harvest could be restricted to weekdays and nonholiday periods. This mitigation measure would be effective in reducing the total number of persons affected by timber harvesting activities especially in the winter when outdoor recreational activity is low (19 percent of the use). Most harvesting activities would occur during the weekdays and nonholiday periods. Within the region most logging activities take place in the winter (43 percent) making implementation of this mitigation likely for a large percentage of the harvest.

- Construct nonpermanent roads into primitive recreation areas. This mitigation could be successful in eliminating permanent motorized use of primitive areas and in maintaining long-term primitive recreational uses in the unharvested areas. Use of nonpermanent roads can reduce the degree and period over which impacts persist. Coordination between ownerships is important to the success of this planning. This measure is unlikely to be implemented because it would require the cooperation of the major timberland ownerships and would also require leadership by the respective state departments of natural resources to initiate and oversee the planning and development of nonpermanent road guidelines and their implementation.

- Provide a 200 foot buffer zone around visually sensitive areas and restrict the size and shape of clearcuts. In addition, where possible, use silvicultural techniques in visually sensitive areas that maintain a forest canopy cover such as selective harvest and thinning. Given the generally flat to undulating terrain in the procurement area, under most circumstances, a buffer of 200 feet would be successful in completely removing visual impacts. This mitigation is implemented on public lands as part of visual management guidelines. However, it is unlikely that this mitigation would be implemented on private lands because the reduction of available timber would reduce the economic benefit of the sale.

- Private landowners could follow the same management guidelines for visual quality established in the federal and state forest for areas around visually sensitive resources. This mitigation would be successful in eliminating most visual impacts. It is unlikely that this mitigation would be implemented on private lands because of the

additional cost to plan and set out timber sales in accordance with guidelines and because the reduction of available timber would reduce the economic benefit of the sale.

Transportation. Timber harvesting activities for the proposed sawmill would increase the amount of logging traffic within the procurement area. It is expected that 20 daily truck loads of timber would be required to support the sawmill based on maximum output. Other equipment, such as skidders, would be used within the harvest area and would not affect traffic. If the 20 truck loads of timber were focused on one harvesting site, the level of increased traffic in a work day would not be sufficient to affect the LOS on regional roads. However, this truck traffic could interfere with recreational users on the unmaintained and maintained dirt/gravel roads by creating dust and/or causing road damage. On public lands, the potential for road damage is generally precluded through contract provisions and enforced through the performance bonds. On private (especially nonindustrial) lands, road damage may be more prevalent. Impacts on any one road would be expected to be short term, the duration of the timber harvest. Some dirt/gravel roads may be closed where the mix of truck and automobile traffic could be a safety concern. The exact size and locations of the individual harvest within the procurement area are not known. However, it is assumed that harvest sites would average 80 acres with approximately 0.5 miles of new haul road being constructed at each location (44 miles total within the procurement area) per year, increasing localized access.

Mitigation Measures

The following mitigation measures could be implemented to reduce timber harvesting effects on transportation within the procurement area.

- Conduct timber harvest during the winter or during seasons when recreational use of haul roads is low. In addition, harvests could be restricted to weekdays and nonholiday periods. This mitigation would be successful in reducing the conflict between recreational and truck traffic. Most harvesting activities would occur during the weekdays and nonholiday periods. Within the region most logging activities take place in the winter (43 percent) making implementation of this mitigation likely for a large percentage of the harvest area.

Hazardous Materials and Hazardous Waste Management. Hazardous materials and hazardous waste management concerns associated with timber harvesting activities would be related to chemical and harvesting equipment use.

Chemicals that would generally be used for forest management include pesticides (insecticides, herbicides, and fungicides) and fertilizer. Chemicals are a preventive technique to minimize the impact of insects, diseases, and

unwanted vegetation. When improperly applied, these chemicals can contaminate surface water or groundwater when they drift, flow overland as runoff, or leach through the soil into groundwater. Most water quality problems associated with pesticides and fertilizers are caused by spills or improper spraying directly on surface water.

Herbicides used in forestry have little potential for leaching and have low bioaccumulation potential. However, some danger exists in direct application to forest streams and ponds, particularly with aerial applications. Leaves falling into streams are an additional route of entry for some insecticides. Indirect effects, such as change in community structure for aquatic species, elicit most concern about pesticide effects because little is known about them. Pesticides can be anticipated to enter the forest stream food chain if fish ingest food organisms which have been exposed to the chemicals. However, few data are available which quantify the extent to which entry does occur (Jaakko Poyry Consulting, Inc., 1992b). This problem could increase if the demand for timber for the proposed sawmill leads to an expansion of intensively managed plantations in the area, accompanied by a commensurate increase in the use of aerially applied pesticides.

When used properly, chemicals should not affect water quality. Use of pesticides is regulated by the U.S. EPA which requires that the chemical user follow labels on the containers. All pesticides are classified for general or restricted use. Restricted pesticides may be used only under the supervision of certified applicators. In addition, aerial spraying also requires a licensed applicator. The utilization of BMPs in both Michigan and Wisconsin on public and industrial forest lands reduces the potential for impacts from pesticides. Private nonindustrial landowners are required to follow the appropriate labeling requirements and must use certified applicators for restricted chemicals.

Logging, road building, and other forest activities require motorized equipment. Antifreeze, fuels, and lubricants used in machinery can potentially pollute lakes, streams, wetlands, and groundwater. However, any emergency spills are required to be reported to the proper state agency so the required cleanup can be performed. The amount of vehicles and equipment required daily for the proposed timber harvesting activities is expected to be small (9 trucks, 12 skidders, and 6 harvesters). Portable storage tanks used on site (i.e., diesel fuel) would be required to be used in accordance with applicable federal, state, and local regulations

Mitigation Measures

The following mitigation measures could be implemented to reduce hazardous materials and hazardous waste impacts from harvesting within the procurement area.

- Utilize BMPs on private lands as part of the overall timber harvest management. Utilization of BMPs has been successful in reducing chemical and hazardous materials/waste effects. Adherence to BMPs on private lands have been shown to be high (around 92 percent); therefore, it is likely that they would be utilized.

- Properly handle hazardous materials and waste during routine vehicle maintenance. Vehicles should be properly maintained to reduce the potential for release. Fueling areas should be located away from water bodies and drainage structures and at locations where a potential spill can be contained. The respective state agency should be notified of any spill when it occurs. Utilization of these BMPs has been successful in reducing chemical and hazardous materials/waste effects. Adherence to BMPs is expected on public lands, and has been shown to be high on private lands; therefore, it is likely that they would be utilized.

- Apply chemicals in favorable weather conditions (e.g., light or no wind). Chemicals should be mixed and used away from riparian zones when possible. In riparian areas spot-injection spraying methods should be utilized. This measure would be successful in reducing the effects of the inappropriate application of chemicals in the forest. Because most chemicals are applied by a certified applicator and adherence to BMPs is expected to be high, it is likely that this mitigation would be implemented.

Geology and Soils. The impact that timber harvesting has on the rate of soil erosion depends on many variables including soil type, site conditions, season of harvest, application of water quality BMPs, and timber sale layout and design. Short-term erosion impacts are associated with the soil loss that accompanies typical harvesting operations prior to revegetation. Long-term impacts occur when the quantity of soil eroded would require decades to replace at the prevailing rate of soil formation. As a general rule, clearcutting would create more soil erosion than thinning, given similar conditions.

Soil losses can impact site productivity by removing nutrients bonded to eroded particles and by reducing the volume of soil available on the site. Nutrient loss can be exacerbated by losses of the organically rich upper soil horizon due to surface erosion. Off-site impacts can occur via sedimentation, which reduces water quality and can adversely affect aquatic ecosystems. Most soil erosion from timber harvesting activities would be from the heavily trafficked areas (i.e., skid trails) within the harvest unit and on haul roads (Jaakko Poyry Consulting, Inc., 1994).

The rate of erosion associated with haul roads would be faster than on other areas of the harvested site, because of the more complete removal of surface protection and smoothing of the ground surface in haul roads. Analyses indicated that maximum initial erosion rates for haul roads could

approach 100 tons/acre/year in some areas (Jaakko Poyry Consulting, Inc., 1994). Since BMPs are implemented on public and private industrial lands (52 percent of the ownership), very low sedimentation rates are expected on the approximately 23 miles of new haul roads constructed per year on these lands. On private nonindustrial lands, approximately 21 miles of new haul roads would be constructed per year resulting in 4,300 tons per year of soil erosion if no BMPs were implemented. However, implementation of BMPs on private nonindustrial lands in Minnesota average 92 percent and similar implementation is expected for the timber procurement area. With the implementation of BMPs on 92 percent of these lands, the amount of maximum soil erosion expected would be reduced to 344 tons per year. The increased soil erosion rates for haul roads may be more important in terms of water quality impacts (see Water Resources below) than overall loss of soil productivity. Overall, it is expected that localized short-term impacts from timber harvesting would occur from clearcutting (generally within the first 2 years) and road construction.

Mitigation Measures

The following mitigation measures could be implemented to reduce soil erosion from harvesting within the procurement area.

- Utilize BMPs on private lands as part of the overall timber harvest management. Utilization of BMPs has been found to be successful in reducing soil erosion effects to water quality. Adherence to BMPs is expected on public lands and has been shown to be high on private lands; therefore, it is likely that they would be utilized.

- Limit operations to periods of adequate soil strength, concentrate equipment traffic to defined areas, and develop long-term transportation plans. This mitigation would be moderately effective in reducing soil compaction and surface disturbance. Constraints on equipment operation during susceptible periods will require assessments of site condition at an operational scale if preventive measures are to be effective. The public and larger forest industry landowners are better equipped to undertake this mitigation. It is unlikely that planning and assessment on nonindustrial private lands would reach the level of sophistication, and consequently this mitigation is unlikely to be feasible on these lands.

- Conduct proper road engineering (such as water bars, pipe culverts, and diversion ditches), revegetate bare soil areas, and close temporary roads after harvest. These activities would be successful in reducing soil erosion along forest roads and skid trails, the major areas where erosion problems caused by forest management activities occur. Adherence to BMPs on private lands has been shown to be high; therefore, it is likely that they would be utilized. It is expected that this mitigation would be implemented on public lands.

Water Resources. Removal or alteration of forest cover and associated forest management activities on a watershed has wide-ranging effects on water resources. Timber management often affects the amount, timing, and quality of water yield. Disturbance to the soil surface increases soil erosion and sediment inputs to water bodies. Changes in the riparian canopy alter inputs of organic nutrients (which are a central food resource for aquatic communities) and affects the amount of light reaching the water surface. Light in turn affects primary producers (i.e., algae and higher plants) and may cause water temperatures to increase. All of those changes affect the species composition, and growth and production of the animals that inhabit water resources. Clearcutting and road construction from timber harvesting activities present the greatest impact to water resources. For the timber harvest activities, it is anticipated that 4,300 acres per year would be clearcut and an additional 0.5 miles of road per harvest area (44 miles total within the procurement area) would be constructed per year. Impacts discussed below result mostly from clearcutting and road construction.

The main sources of non-point source pollution to the forest are sediment, organic debris, nutrients, temperature, chemicals, and stream flow. Impacts from chemicals are addressed under Hazardous Materials and Hazardous Waste Management. Forest management activities, such as road building, can remove soil protection which can lead to soil erosion, creating sediment. Sediment is the primary pollutant associated with forestry activities, especially at stream crossings for haul roads or skid trails. Erosion from poorly located and maintained stream crossings and other areas of unstable soil left after harvesting would cause localized water quality impacts. These local areas would generally exhibit higher sediment production rates after the first 2 years post-harvest. However, increased sediment production levels on these sites would not be permanent.

Organic debris from timber harvesting activities can decrease dissolved oxygen in the water, which fish need to thrive. Nutrients, such as nitrogen and phosphorous, exist naturally in forest soils and can enter water bodies if the soils erode into the water. Excessive amounts of nutrients may cause algal blooms in lakes and streams, which can reduce levels of dissolved oxygen in the water below that which fish and other aquatic species need to survive. Removing vegetation along stream banks from timber harvesting can increase solar radiation which, in turn, can increase water temperatures and eliminate fish species adapted to cold water, reduce dissolved oxygen, and affect the metabolism and development of fish. Timber harvesting activities can increase peak streamflow which increases the chance for flooding, stream bank erosion, and sedimentation. Timber harvesting activities in some areas can increase snowmelt and thus peak stream flows.

The overall increase in non-point pollution discharge from the proposed timber harvesting would be based on the implementation of BMPs. When BMPs are implemented, such as 150-foot buffer strips around water bodies,

little to no effect on water quality occurs (Jaakko Poyry Consulting, Inc., 1994). On public and private industrial lands BMPs are implemented to reduce water quality effects. On private nonindustrial lands, BMPs are used on a voluntary basis. On private nonindustrial forests where the implementation of BMPs would be lower, impacts would be expected to be greater. For construction of haul roads that cross streams, a permit may be required from the MDNR, WDNR, or COE. Overall, it is expected that localized short-term impacts from timber harvesting would occur from clearcutting and road construction during the first 2 years following a harvest.

National and state-designated wild and scenic rivers within the procurement area are protected from forest management activities on both public and private lands. Timber harvesting near a designated river is regulated through a permit process or state and local zoning ordinances. Techniques typically used near designated rivers include buffer strips. Because of the existing regulatory process few impacts to designated wild and scenic rivers are expected.

Mitigation Measures

The following mitigation measures could be implemented to reduce water quality effects from harvesting within the procurement area.

- Utilize BMPs on private lands as part of the overall timber harvest management. Utilization of BMPs has been found to be successful in reducing most water quality impacts and associated biological impacts. Adherence to BMPs on private lands has been shown to be high; therefore, it is likely that they would be utilized.

- Document all possible threats to water quality including access problems prior to the timber sale. Effective planning represents the single most important feature in the successful implementation of BMPs and the reduction of water quality impacts. On public lands this BMP is implemented in order to reduce both water quality impacts and poor road construction design. Implementation of this mitigation is likely on private land because of its relative low expense and elimination of problems associated with poor road design.

- Establish filter strips 25 feet wide along constructed roads and harvest areas next to intermittent and permanent streams, lakes, rivers, and wetlands. A filter or buffer strip is an area adjacent to a water body which acts to trap and filter out suspended sediments. Wider strips should be used as slopes, slope length, and soil erodibility increase. These techniques reduce sediment-carrying capacity of roadway runoff by reducing velocity. This mitigation would be successful in capturing most sediments before they enter the stream. This mitigation is implemented on public lands as part

of BMPs. Adherence to BMPs on private lands has been shown to be high; therefore, it is likely that they would be utilized.

- Prevent unmitigated crossing of all permanent streams at any season and of streams large enough to have open water during the winter. Planning of road construction can reduce the number of required stream crossings substantially. Mitigated crossings are successful in substantially reducing water quality impacts relative to unmitigated crossings. The feasibility of this mitigation should be the same as establishing filter strips.

Air Quality. Most effects from timber harvesting would be short-term lasting the duration of each harvest. The emissions from a harvest would be from the mobile equipment, such as diesel trucks, skidders, loaders, and tree cutting equipment; dust associated with road construction and ground disturbance; and smoke when prescribed burning is performed for site preparation after timber harvesting.

The timber procurement area is in attainment for all criteria pollutants. The reason for the good air quality is the small population base and few major industrial sources. The amount of major equipment expected to be in operation per day for the timber harvest would consist of approximately 12 skidders, 6 harvesters, and 9 trucks. Based on the small amount of equipment and that some of the emissions would be dispersed over a large area (harvesting in several different locations), emissions would not effect regional air quality. PM_{10} generated from harvesting activities and along dirt roadways would be localized and short term with the surrounding forest acting as a barrier for dust. Prescribed burning would only be performed when required after a timber harvest to prepare a site for replanting. Air quality impacts associated with this activity would be short term. Before prescribed burning can take place a permit may be required from the county or local department of natural resources. Overall, no new or modified stationary sources would be associated with the harvesting activities and long-term degradation of Class I areas or changes in regional air quality are not expected.

Mitigation Measures

The following mitigation measures could be implemented to reduce air quality effects from harvesting within the procurement area.

- Maintain equipment in good operating condition to reduce air emissions associated with road construction and other ground disturbances. This mitigation would be successful in reducing air pollutants from timber harvesting equipment. Because the good operating condition of equipment extends the life of the equipment, saves fuel, and maintains safety it is likely that this mitigation could be implemented.

- Maintain a forest barrier near sensitive receptors to reduce PM_{10} emissions. The forest barrier mitigation has been found to be very successful in reducing dust around construction sites, and with operations that generate large amounts of dust such as sand and gravel sites. Because some forest barrier would be maintained during harvesting, it is likely that this mitigation would be implemented.

- Burns should be conducted in weather conditions which would move smoke away from local sensitive receptors (i.e., residential and recreation areas). Consideration of downwind receptors would be successful in eliminating most of the temporary air quality effects of prescribed burns. The likelihood of implementation of this mitigation is high on public and industrial lands, where long-term management goals govern activities. On nonindustrial private lands implementation of this mitigation measure in less likely.

Noise. The duration and levels of noise from chain saws, skidders, and heavy truck traffic during harvesting activities would differ between the types of harvesting. However, the general types of noise expected would be similar regardless of the method of harvesting that is used. The overall effect of noise for each harvest can be considered short term. The areas where timber harvesting for the proposed sawmill would take place currently experience noise from various sources including timber harvesting activities, motorized recreational uses, and gun fire from hunting.

The increase in short-term noise levels associated with the timber harvesting could affect the quality of nonmotorized recreational experiences. Timber harvesting near campgrounds or trails could disrupt the solitude that many persons associate with a forest environment. Winter harvest would affect fewer recreational experiences, because of the decreased use of the nonmotorized recreation resource and increased use of motorized activities such as snowmobiling. Winter sports account for approximately 19 percent of the outdoor recreational hours (Jaakko Poyry Consulting, Inc., 1993). The increase in harvest activities associated with the proposed sawmill may cause more harvest to take place closer to recreational resources and, therefore, increased noise exposures to sensitive receptors. However, because each timber harvest would occur within a short time frame, no long-term impacts are expected. In addition, the overall volume of timber harvested within the procurement area for all species would increase by only 2 percent because of the proposed mill and should not produce a noticeable change to the overall noise environment.

Mitigation Measures

The following mitigation measures could be implemented to reduce noise effects from harvesting within the procurement area.

- Conduct timber harvest during the winter months or during seasons when recreational use of the forest is low. This mitigation would be successful in reducing the total number of persons affected by noise caused by timber harvesting activities. Most harvesting activities would occur during the weekdays and nonholiday periods. Within the region most logging activities take place in the winter (43 percent), making implementation of this mitigation likely for a large percentage of the harvest area.

- Conduct harvest activities away from popular recreational areas. Since chain saw and truck noise can travel up to 3 miles, the harvest area should exceed this distance from the recreational resource or be limited in duration or operational hours (i.e., weekdays). This mitigation would be successful in reducing noise impacts next to recreational sites when they are being used. On public lands where the forest is managed for both timber and recreation, it is likely that timber harvest would be conducted away from developed recreation areas. On private lands it is unlikely that this mitigation would be implemented unless the owner has an established recreation site on the property.

Biological Resources. Effects on biological resources from timber harvesting activities, and the extent to which they may occur, depends on the timing of the harvest, amount of timber harvested, the harvesting method, where the harvesting takes place, and the changes in vegetation that would result from the timber harvest. Land management objectives would greatly influence the floral and faunal components of a site managed for timber. Threatened and endangered species and sensitive habitat areas also are subject to effects of timber management activities. Most negative effects can be avoided or minimized through compliance with existing regulations, application of appropriate BMPs, and adherence to forest management plans, where applicable. Beneficial effects can also occur on those areas that are managed from an overall health perspective.

<u>Vegetation</u>

Timber harvesting activities may induce change and influence age, species diversity, density, forest health, and other factors associated with vegetation. These vegetation features, in turn, influence the quality of an area's habitat and its value to wildlife. Vegetation composition is dynamic within a managed forest environment. As trees mature on a harvested area, less light is provided to the forest floor which may affect temperature and available moisture. Prior to harvest, shade tolerant herbs, shrubs, and tree species would tend to prosper. After the harvest, however, changes to the site and disturbance to vegetation would alter species composition to favor those adapted to take better advantage of the warmer, drier, more exposed site. This species composition changes dynamically throughout the rotation cycle. Because mature trees can be a dominating influence over the type and density of other vegetation growing on a stand, the goals, objectives,

and methods for carrying out timber harvest activities can profoundly affect the site. In general, the silvicultural methods, site preparation techniques, and other management factors will determine what vegetation will occur on a site during the rotation cycle. Undesirable effects would generally be associated with a lack of planning, proper site maintenance, or adverse environmental factors, such as fires, flood, drought, or health vector.

Most of the area within the timber procurement area has been previously harvested and is managed for continued use of the timber resources. Effects on vegetation from timber harvesting activities are primarily related to changes in forest diversity. Maintaining current levels of forest diversity is favorable, although not necessarily optimum. If clearcutting is selected, shade intolerant species would initially have an advantage in the openings. Effects of fragmentation of the forest may change the competitive relationship among interior and non-interior species. For example, ferns (interior species) will grow better with more light at the edge of the forest, but they cannot compete with grasses which grow better in high light openings. Insect and disease infestations could be curtailed by interrupting the forest with open areas. Better browse and other food sources would be available in these open areas for deer, raptors, and song sparrows. Properly managed clearcutting as a function of scale, spatial arrangement, and application timing can have a positive effect on biodiversity by providing variable habitat niches and edges that can be used by many different species. As discussed above, current management activities are in place that help to minimize effects of any type of harvesting approach.

Wildlife

Impacts to wildlife from timber harvesting activities would include short-term removal of habitat. This could occur in both public and private forest. Harvest activities would tend to result in direct mortality of less mobile species, such as the spotted salamander, and the displacement of mobile species, such as birds and large mammals. Fragmentation of habitat can reduce the diversity of the gene pool in less mobile species as their range can be decreased. Fragmentation provides more edge habitat, which can be characterized as having more light and more exposure to wind resulting in drier conditions than interior forest habitat. Certain species have adapted to edge habitats, while others have adapted to interior habitats. Therefore, a landscape with many isolated stands may ultimately exclude interior species.

Sensitive species requiring isolation and/or large unbroken tracts of land such as the cooper's hawk may be adversely affected until trees again mature. Displacement of mobile species could lead to resource shortages increasing competition for forage, prey, or water in surrounding uncut areas. Displaced cavity nesting species such as the barred owl, may not return if snags and cavity trees are removed.

The effects of increased road use and road development on wildlife and sensitive species also need to be considered. Increased human activity and increased noise from vehicles and timber harvesting could displace some wildlife species or negatively affect breeding success. For the most part, songbirds and perching birds return immediately despite heavy road traffic. Deer, black bear, and grey fox, which are displaced during construction may tend to avoid the road corridor if it is heavily used. Brushy margins of roads may increase habitats for edge species, such as the vole, by providing some horizontal and vertical diversity.

Beneficial effects of timber management on wildlife include the creation of edge environments and diverse forest cover. Species such as the white-tailed deer and moose can take advantage of increase browse found in openings created by harvest activities. As with vegetation, the overall impacts to wildlife associated with timber management activities are largely dependent on long-term goals and objectives, site conditions, and their environmental factors.

Threatened and Endangered Species

Habitat changes may directly or indirectly affect threatened and endangered species. These impacts to threatened or endangered wildlife could include the direct loss of foraging or breeding habitat which could adversely affect populations of individual species. For example, the pine marten prefers large uncut areas for habitat. Studies have shown pine marten densities which are three times greater in large blocks of uncut forest than forest where half of the area has been clearcut. Regenerating clearcuts up to 30 years old were still used less than nearby uncut areas. Impacts to sensitive plant species could include direct loss of individual species during harvesting or indirect effects caused by increased soil erosion or change to the habitat.

Timber harvesting activities on public and private lands are required to adhere to the federal Endangered Species Act and regulations protecting sensitive species in Michigan and Wisconsin. If unmitigated, or in the absence of BMPs, harvest activities would tend to have overall adverse effects on threatened or endangered species. With implementation of BMPs however, and in the context of ecosystem management, silvicultural activities can result in a net benefit to sensitive species. For example, the Kirtland warbler relies on even-aged stands of young and intermediate-aged jack pine for its survival. Managing stands to achieve this habitat type can increase available habitat to this species. Forest management goals and objectives can greatly affect the viability of sensitive species within the procurement area.

Sensitive Habitats

Wetlands or riparian areas may be affected directly by the cutting of trees and movement of vehicles through the area, or indirectly by runoff from upslope areas. Wetlands can be affected by increased organics or sediment, or temperature and light fluctuations associated with timber harvesting which could alter the functional value of the wetland. Timber harvesting has a short-term effect on riparian vegetation during the operation period and long-term effects on vegetative age-class distribution and type composition. Effects in these areas are reduced through the use of appropriate harvesting and/or regeneration methods, which could also reduce the effects on the area's wildlife. Dredge and fill activities in wetlands are regulated by the federal government and the states of Michigan and Wisconsin. Implementation of BMPs would be expected to be greatest on public and industrial private forest lands thereby precluding impacts there. Adverse impacts to wetlands would be most likely to occur on the nonindustrial private lands in the procurement area. Overall, compliance with federal and state regulations governing wetlands by the forest manager would minimize effects to wetland areas.

Mitigation Measures

The following mitigation measures could be implemented to reduce effects to biological resources from harvesting within the procurement area. Additional mitigations identified in soils and geology and water resources would also serve to preclude impacts to biological resources. Because wildlife is managed on public lands these mitigation measures mostly apply to private lands.

- Extended Rotation Forest. Manage even-aged forest with extended rotations (i.e., longer than optimum economic rotations). Many of the impacts anticipated from forest harvesting are related to the removal of mature forest. This mitigation would be successful in minimizing impacts to many birds associated with mature forest (e.g., barred owl, boreal owl, red-shouldered hawk), and small and medium-sized mammals (e.g., pine marten, tree squirrels, voles, bobcat, lynx). This strategy is of long-term duration, quite feasible physically, and is very effective under certain circumstances. Financially, this strategy requires administrative guidelines that would cost time and money during preparation of the timber sale. In addition, the cost of growing and harvesting the timber would be higher, because the mitigation would reduce timber production and require less intense harvest over a larger area or harvest over a longer time or at a greater expense. The implementation of this mitigation on private lands would be dependent on the cost.

- Riparian Zones. Maintain a forest buffer along both banks of all streams and lakes. Buffers should be developed in accordance with BMPs identified by the appropriate land management entity for the

respective state. Within the buffer, only thinning and uneven-aged management should be permitted. Options for longer rotation and thinning cuts, which would be carried out during nonbreeding season (September to February) are also recommended. This mitigation would be successful in minimizing impacts to amphibians and reptiles and many bird species such as the Cerulean warbler. Implementation of this measure is likely on public lands which are managed for timber harvesting, as well as for riparian habitats. On private lands some buffer strips near riparian zones are maintained as part of water quality BMPs; however, it is unlikely that, without state administered guidelines, the option for longer rotation and thinning carried out during nonbreeding season would be implemented.

- <u>Spatial Patterns of Cutting.</u> Tailor the size and shape of both cuts and uncut zones, within economic and administrative feasibility to meet varying habitat needs of native wildlife; and wildlife travel corridors should be provided, particularly in clearcuts that are large and elongated. Corridors will be important to the pine marten, red squirrel, flying squirrel, deer, and snowshoe hare. The feasibility of implementation of this mitigation would be the same as for extended rotation forest.

- <u>Retention of Conifers.</u> Retain a reasonable representation of conifers by region, species, and drainage type for the many habitat characteristics that conifers provide to vertebrate fauna in a large portion of the procurement area. Conifer stands, inclusion of conifers within stands of mixed species, and conifer understories in old aspen and birch stands are all components of wildlife habitat in the procurement area. Many songbirds and raptors either breeding in or migrating through the forest are associated with conifer cover. White-tailed deer and moose use conifer cover during winter because of the reduced wind chill and lower, less crusted snow cover. This mitigation would be successful in maintaining a diverse wildlife habitat in the procurement area. The feasibility of the implementation of this mitigation would be the same as for extended rotation forest.

Cultural Resources. Most cultural resources are very fragile and can be seriously affected by timber harvest and associated activities, such as road construction. These resources are fragile because dislocation of artifacts and the sediments which contain them can destroy or seriously compromise the essential information which they contain. The earth-disturbing activities do not have to be intense to impact such sites (Jaakko Poyry Consulting, Inc., 1994).

The two principal types of impacts caused by timber harvesting include site alteration and transfer, both of which result in the removal of artifacts from the site. The timber harvesting operations that could account for most impacts to cultural resources include construction of access roads, skid

roads, trails and landings, and preparation of sites for regeneration for planting. Traditional use sites can be altered through change in vegetative cover, reduction of availability of certain plants and animals, and changes in frequency and mode of public access.

It is likely that any unidentified cultural resource within the a harvest area could be impacted. Within Michigan and Wisconsin, the areas along lake shores and streams or rivers have the greatest density of prehistoric sites. Few prehistoric sites have been discovered away from the lake shores and rivers. Therefore, timber harvesting activities along the high density areas could impact many unidentified sites. Historic sites, such as logging camps, can be found anywhere within the timber procurement area. Based on the density of sites that can be expected to be found in the procurement area, between 9 and 40 additional sites from the proposed harvesting could be impacted per year on non-federal land where no cultural resources surveying is conducted prior to harvesting.

On federal lands cultural resources are protected under the NHPA, and areas with a high potential for sites are typically surveyed prior to harvesting activities to identify and avoid any potentially eligible sites. On state, county, and private lands, harvest areas are not typically surveyed prior to harvesting activities.

Mitigation Measures

The following mitigation measures could be implemented to reduce effects to cultural resources from harvesting within the procurement area. Because cultural resources are protected on federal lands, these mitigation measures apply to state and local governments, and private lands.

- Consult the Michigan and Wisconsin SHPO's prior to timber harvesting to identify areas, which may have been surveyed, and any potential sites so they may be avoided. This mitigation would be successful in eliminating overlapping surveys and in avoiding sites previously discovered. Although an inexpensive mitigation to implement to avoid existing recorded sites, it is not likely that this would be implemented on private lands. This practice is used on state-owned public lands in both states.

- All landowners could initiate programs of site surveys prior to timber harvesting activities. Conducting surveys prior to timber harvesting would be successful in identifying and avoiding impacts to cultural resources. Because of the expense associated with site surveys, it is unlikely that this mitigation would be implemented.

- In the absence of routine surveys to protect archaeological sites, other measures designed to minimize the extent and degree of physical soil impacts would likely reduce the number of sites

impacted. These measures include: harvesting when soil strength is the highest, particularly during winter, over snow; introducing the use of low impact harvesting equipment and harvesting techniques which reduce soil damage. Because this mitigation is dependent on many factors, such as weather conditions and equipment operators there is no way to anticipate effectiveness. The task of identifying candidate areas, monitoring ground conditions, and supervising operations would result in a commitment of funding and resources making it unlikely that this mitigation would be implemented.

- Conduct harvesting activities away from high site density areas (e.g., lake shores, streams, and rivers). This mitigation would be successful in reducing most disturbances to potential prehistoric sites. Because the use of BMPs to protect water bodies (e.g., 200-foot buffer strips), it is likely that this mitigation would be implemented on state and county lands.

4.7 ENVIRONMENTAL JUSTICE

As described in Section 3.7, the disproportionate low-income and minority populations have been identified in eight BNAs within Marquette County (see Figure 3.7-1).

The analysis conducted for this EIS included a review of influencing factors (local community resources), and a discussion of resulting impacts associated with hazardous materials and hazardous waste management and the natural environment. Local community resources (e.g., community setting, land use and aesthetics, transportation, utilities) have been identified as influencing factors only, and therefore would not disproportionately affect low-income and minority populations resulting in environmental justice impacts.

Environmental justice impacts can arise as a result of the use of hazardous materials and generation of hazardous waste. Impacts may also occur to soils and geology, water resources, air quality, noise, biological resources, and cultural resources as a result of reuse-related development activities.

Based upon the analysis conducted for this EIS, it was determined that reuse activities associated with the Proposed Action and alternatives would not affect low-income and minority populations for the following resources: hazardous materials and hazardous waste management, geology and soils, water resources, air quality, aircraft-related noise, biological resources, and cultural resources. Impacts associated with disposal and reuse of K. I. Sawyer AFB identified for these resource areas would be contained within the base boundary; therefore, there would be no environmental justice impacts. Additionally, activities associated with reuse would not affect the air quality attainment status of Marquette County; thus, disproportionate air

quality impacts to low-income and minority populations would not be expected.

Reuse activities may, however, cause potential noise impacts associated with off-base surface transportation that could include the eight BNAs identified as having disproportionate low-income and minority populations in Marquette County. These off-base noise effects are discussed below.

Minimal environmental impacts are anticipated to result from the reuse of Marquette County Airport. Anticipated effects include minor soil erosion, increased storm water runoff, regional increases in VOCs, NO_x, SO_x, surface traffic-related noise, wildlife displacement, and indirect effects to wetlands. These impacts are generally contained to the immediate area surrounding Marquette County Airport, and no disproportionate low-income or minority BNA has been identified within 1 mile of the airport. Thus, no environmental justice impacts are anticipated from reuse of the airport.

4.7.1 Noise

Under all of the alternatives, reuse-related surface traffic noise may affect low-income and minority residents within one area, located along SH 35 between CR 553 and CR 456, within BNA 25. Residents in this BNA may therefore experience environmental justice impacts.

Mitigation Measures

Mitigation measures for potential environmental justice impacts associated with surface traffic noise would be similar to those identified for other noise impacts under the Proposed Action (see Section 4.4.4.1, Proposed Action).

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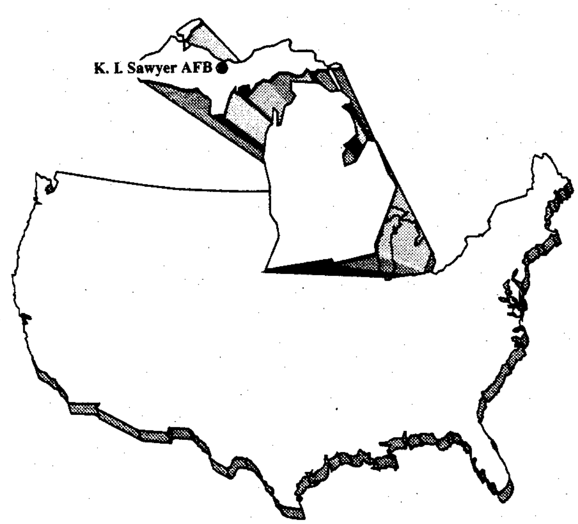


CHAPTER 5
CONSULTATION AND COORDINATION

5.0 CONSULTATION AND COORDINATION

The federal, state, and local agencies and private agencies/organizations that were contacted during the course of preparing this EIS are listed below.

FEDERAL AGENCIES

Advisory Council on Historic Preservation
Federal Aviation Administration
Federal Highway Administration
United States Army Corps of Engineers
United States Army Reserve
United States Department of Agriculture, Forest Service
United States Department of Agriculture, Natural Resources Conservation Service
United States Department of the Interior
United States Fish and Wildlife Service
United States Geological Survey

STATE AGENCIES

Michigan Army National Guard
Michigan Commission on Indian Affairs
Michigan Department of Agriculture
Michigan Department of Natural Resources
Michigan Department of Social Services
Michigan Department of Transportation
Michigan Employment Security Commission
Michigan Natural Features Inventory
Michigan Office of Tax and Revenue Analysis
Michigan Public Health Department
Michigan State Historic Preservation Office
Michigan Transportation Commission
Michigan Travel Bureau
Northern Michigan University

LOCAL/REGIONAL AGENCIES

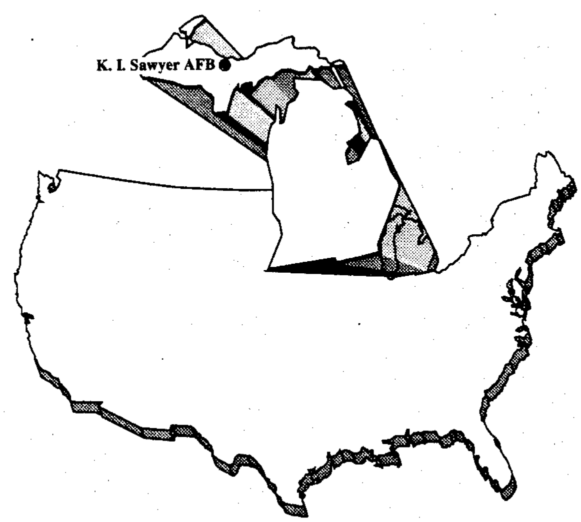
Bay De Noc Community College
Central Upper Peninsula Planning and Development
Chocolay Township
City of Ishpeming

LOCAL/REGIONAL AGENCIES (Continued)

City of Marquette
City of Marquette Wastewater
Forsyth Township
Gwinn Area Community Schools
Ishpeming Police Department
Ishpeming Public Schools
K. I. Sawyer Base Conversion Authority
Marquette Area Public Schools
Marquette County Airport
Marquette County Economic Development Corporation
Marquette County Historical Museum
Marquette County Planning Department
Marquette County Resource Management Department
Marquette County Sheriff's Department
Marquette County Solid Waste Management Authority
Marquette Township
Michigan State Police
Negaunee Public Schools
Negaunee Township
Olympic Education Center
Sands Township
West Branch Township

PRIVATE ORGANIZATIONS AND INDIVIDUALS

Bell Memorial Hospital
Century 21
Cliffs Mining Services Company
Closser Associates
Downtown Marquette Association
First National Bank
Forwood Housing Project
Marquette Board of Light and Power
Marquette Chamber of Commerce
Marquette General Hospital
Marquette Tourism Council
Michigan Consolidated Gas Company
Northern Michigan Economic Initiatives
Upper Peninsula Power Company



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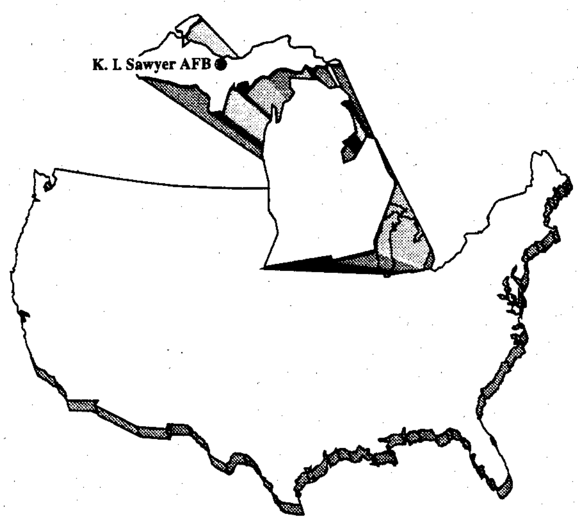

CHAPTER 7
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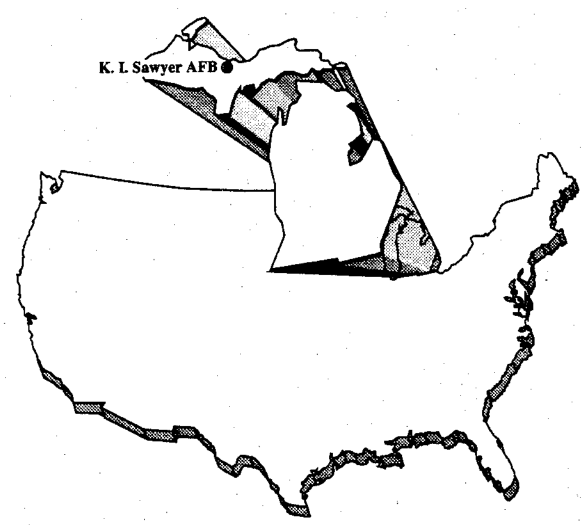

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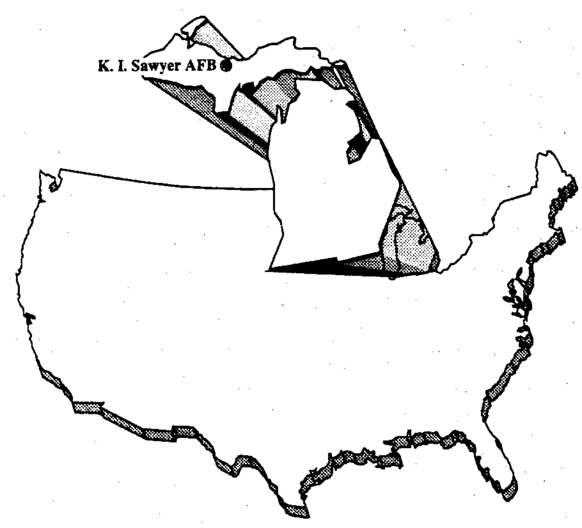

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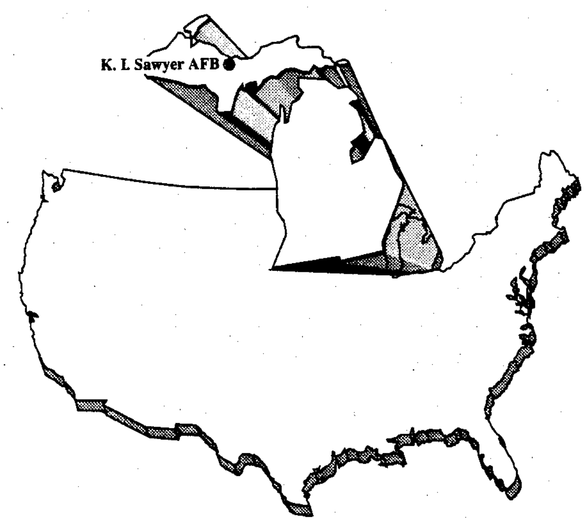

APPENDIX A

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GLOSSARY OF TERMS AND ACRONYMS/ABBREVIATIONS

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GLOSSARY OF TERMS

A-Weighted Sound Level. A number representing the sound level that is frequency weighted according to a prescribed frequency response established by the American National Standards Institute (ANSI S1.4-1971) and accounts for the response of the human ear.

Abatement. Any set of measures designed to permanently eliminate health and environmental hazards. These may include (1) removal, permanent containment or encapsulation, or replacement and (2) all preparation, cleanup, disposal, and postabatement clearance testing activities associated with such measures.

Accident Potential Zone (APZ). APZs include a 3,000-foot by 3,000-foot clear zone at each end of the runway and areas designated as APZ I and APZ II extending beyond the clear zone. The accident potential in the clear zone is so high that necessary land use restrictions prohibit reasonable economic use of the land. APZ I is less critical, but still possesses a significant risk factor. APZ I is a 3,000-foot by 5,000-foot area with land use compatibility guidelines that are sufficiently flexible to allow reasonable economic use of the land. APZ II is less critical than APZ I; APZ II is a 3,000-foot by 7,000-foot area, extending to 15,000 feet from the runway threshold.

Acoustics. The science of sound, which includes the generation, transmission, and effects of sound waves, both audible and inaudible.

Advisory Council on Historic Preservation. A 19-member body appointed, in part, by the President of the United States to advise the President and Congress, and to coordinate the actions of federal agencies on matters relating to historic preservation, to comment on the effects of such actions on historic and archaeological cultural resources, and to perform other duties as required by law (Public Law [P.L.] 89-655; 16 U.S. Code 470).

Aesthetics. Referring to the perception of beauty.

Air Installation Compatible Use Zone (AICUZ). A concept developed by the Air Force to promote land use development near its airfields in a manner that protects adjacent communities from noise and safety hazards associated with aircraft operations, and to preserve the operational integrity of the airfields.

Aircraft operation. A takeoff or landing at an airport.

Alluvium. Clay, silt, sand, gravel, or similar material deposited by running water.

Ambient Air Quality Standards. Standards established on a state or federal level that define the limits for airborne concentrations of designated "criteria" pollutants (nitrogen dioxide, sulfur dioxide, carbon monoxide, total suspended particulates, ozone, and lead), to protect public health with an adequate margin of safety (primary standards) and to protect public welfare including plant and animal life, visibility, and materials (secondary standards).

Amplitude. The maximum value of a periodically varying quantity during a cycle.

Aquifer. The water-bearing portion of subsurface earth material that yields or is capable of yielding useful quantities of water to wells.

Archaean. The oldest portion of the Precambrian; rocks that have been dated from the Archaean and range from approximately 2.8 to 3.3 billion years old.

Archaeology. A scientific approach to the study of human ecology, cultural history, and cultural process.

Area of Concern. A location where contamination is likely or suspected, but where further investigation is needed to confirm its presence and whether it is below action levels.

Asbestos. A group of naturally occurring minerals that separate into fibers, including chrysotile, amosite, crocidolite, asbestiform anthophyllite, asbestiform tremolite, and asbestiform actinolite.

Asbestos-containing material. As defined by the Toxic Substances Control Act, asbestos-containing material is any material which contains more than 1 percent asbestos by weight.

Attainment area. A region that meets the National Ambient Air Quality Standards for a criteria pollutant under the Clean Air Act.

Average annual daily traffic (AADT). For a 1-year period, the total volume passing a point or segment of a highway facility in both directions, divided by the number of days in the year.

Average daily traffic (ADT). The typical 24-hour volume of traffic passing a given point or segment of a roadway in both directions.

Base Realignment and Closure (BRAC). Collectively, the Base Closure and Realignment Act of 1988 (Public Law 100-526, 102 Stat. 2623) (also called BRAC 88, or Round I) and the Defense Base Closure and Realignment Act of 1990 (Public Law 101-510, 104 Stat. 1808) (also called BRAC 91, 93, and 95, or Round II, Round III, and Round IV). Department of Defense installations subject to closure or realignment pursuant to these laws are referred to as BRAC installations.

Best management practices (BMPs). Practical and economically achievable methods used to prevent environmental degradation and increase long-term forest health and vigor.

Board foot. Lumber or timber measurement term indicating the amount of wood contained in an unfinished board one inch thick, 12 inches long, and 12 inches wide.

Bi-National Program to Restore and Protect the Lake Superior Basin. In its fifth Biennial Report on Great Lakes Water Quality, the International Joint Commission recommended that "the Parties designate Lake Superior as a demonstration area where no point source discharge of any persistent toxic chemical will be permitted." This document identifies the response of the federal governments of the United States and Canada; the states of Minnesota, Wisconsin, and Michigan, and the Province of Ontario to this recommendation.

Biological Resources. Include the native and introduced plants and animals in the project area.

Biophysical. Pertaining to the physical and biological environment, including the environmental conditions crafted by man.

Bioventing. A remedial technique that injects air into the soils to stimulate bacterial consumption, thus accelerating the breakdown of petroleum-based contaminants in the soils.

Block cut. An even-aged management silvicultural system that results in removal of all merchantable timber in areas less than 5 acres and cut in a rectangular pattern.

Boreal. Literally, "of the North." The boreal zone is the geographical region where short summers and long, cold winters occur, characterized by coniferous forests.

BRAC Cleanup Team (BCT). At each Department of Defense closing or realigning installation where property will be available for transfer to the community, the BCT has authority, responsibility, and accountability for environmental cleanup programs, emphasizing those actions that are necessary to facilitate reuse and redevelopment. BCT members are the base BRAC Environmental Coordinator, the state BCT representative, and the U.S. Environmental Protection Agency BCT representative.

Bucking. Cutting trees or tree parts to predetermined lengths.

Bunching. Collecting and arranging stems or stem parts into piles in the strip.

Cambrian. The oldest Period in the Paleozoic Era, characterized in the fossil record by the first abundant amounts of life; ranges from 500 to 570 million years ago.

Canopy. The more or less continuous cover of branches and foliage formed collectively by the crowns of adjacent trees and other woody ground material.

Capacity. The maximum rate of flow at which vehicles can be reasonably expected to traverse a point or uniform segment of a lane or roadway during a specified time period under prevailing roadway, traffic, and control conditions.

Carbon monoxide (CO). A colorless, odorless, poisonous gas produced by incomplete fossil-fuel combustion. One of the six pollutants for which there is a national ambient standard. See Criteria Pollutants.

Class I, II, and III Areas. Area classifications, defined by the Clean Air Act, for which there are established limits to the annual amount of air pollution increase. Class I areas include international parks, and certain national parks and wilderness areas; allowable increases in air pollution are very limited. Air pollution increases in Class II areas are less limited, and are least limited in Class III areas. Areas not designated as Class I start out as Class II and may be reclassified up or down by the state, subject to federal requirements.

Clearcutting. An even-aged management silvicultural system that results in removal of all timber in a contiguous area of 5 acres or more.

Clear Zone. A 3,000-foot by 3,000-foot area at each end of a military runway where the overall accident risk is so high that necessary land use restrictions would prohibit reasonable economic use of the land.

Commercial aviation. Aircraft activity licensed by state or federal authority to transport passengers and/or cargo for hire on a scheduled or nonscheduled basis.

Comprehensive Plan. A public document, usually consisting of maps, text, and supporting materials, adopted and approved by a local government legislative body, which describes future land uses, goals, and policies.

Conifer. Any tree of the order Gymnospermae, which are predominantly evergreen, cone-bearing trees with needles or scale-like leaves, such as pine, spruce, hemlock, or fir, and producing timber known commercially as softwood.

Contaminants. Undesirable substances rendering something unfit for use.

Control zone. Controlled airspace that extends upward from the surface of the earth and terminates at the base of the Continental Control Area. Control zones that do not underlie the Continental Control Area have no upper limit. A control zone may include one or more airports and is normally a circular area with a radius of 5 statute miles and any extensions necessary to include instrument approach and departure paths.

Convey. To deliver title of property to a nonfederal entity.

Council on Environmental Quality (CEQ). Established by the National Environmental Policy Act (NEPA), the CEQ consists of three members appointed by the President. CEQ regulations (40 Code of Federal Regulations 1500-1508, as of July 1, 1986) described the process for implementing NEPA, including preparation of environmental assessments and environmental impact statements, and the timing and extent of public participation.

Craton. A stable, relatively immobile area of the earth's crust that forms the nuclear mass of a continent or the central basin of an ocean.

Criteria pollutants. The Clean Air Act required the U.S. Environmental Protection Agency to set air quality standards for common and widespread pollutants after preparing "criteria documents" summarizing scientific knowledge on their health effects. Today there are standards in effect for six "criteria pollutants": sulfur dioxide (SO_2), carbon monoxide (CO), particulate matter equal to or less than 10 microns in diameter (PM_{10}), nitrogen dioxide (NO_2), ozone (O_3), and lead (Pb).

Cultural resources. Prehistoric and historic districts, sites, buildings, objects, or any other physical evidence of human activity considered important to a culture, subculture, or a community for scientific, traditional, religious, or any other reason.

Cumulative impacts. The combined impacts resulting from all activities occurring concurrently at a given location.

Day-night average sound level (DNL). The 24-hour average-energy sound level expressed in decibels, with a 10-decibel penalty added to sound levels between 10:00 p.m. and 7:00 a.m. to account for increased annoyance due to noise during night hours.

Decibel (dB). A unit of measurement on a logarithmic scale that describes the magnitude of a particular quantity of sound pressure or power with respect to a standard reference value.

Defense Environmental Restoration Account (DERA). Department of Defense account from which Installation Restoration Program activities are funded.

Disposal. Orderly placement or distribution of property.

Easement. A right or privilege (agreement) that a person may have on another's property.

Effluent. Waste material discharged into the environment.

Endangered Species. A species that is threatened with extinction throughout all or a significant portion of its range.

Environmental Impact Analysis Process (EIAP). The process of conducting environmental studies as outlined in Air Force Instruction 32-7061.

Equivalent sound level (L_{eq}). The equivalent steady-state sound level that, in a specified period of time, would contain the same acoustical energy as time-varying sound levels during the same period.

Erosion. Wearing away of soil and rock by weathering, and the action of streams, wind, and underground water.

Even-aged. Forest stand composed of trees having no or relatively small differences in age. By convention the maximum differences admissible are generally 10 to 20 years.

Excess property. Property that is reported to the General Services Administration as no longer required by a federal agency. This property is then made available to all other federal agencies.

Faults. Fracture in the earth's crust accompanied by a displacement of one side of the fracture with respect to the other and in a direction parallel to the fracture.

Felling. Separating trees at the stump from their growing site.

Feller-buncher. A machine used to fell trees and move then into bunches or windrows.

Fleet mix. Combination of aircraft used by a given agency.

Frequency. The time rate (number of times per second) that the wave of sound repeats itself, or that a vibrating object repeats itself--now expressed in Hertz, formerly in cycles per second.

General aviation. All aircraft that are not commercial or military aircraft.

Groundwater. Water within the earth that supplies wells and springs.

Hardwoods. A conventional term for the timber of broadleaved trees, and the trees themselves, belonging to the botanical group Angiospermae.

Harvester. A self-propelled machine which fells trees and performs at least two processing functions.

Hazardous Air Pollutant (HAP). One of 45 substances (originally 189 substances were listed in the 1990 Amendments) listed in the Clean Air Act as pollutants that present or may present a threat of adverse human health effects or adverse environmental effects when released into the air.

Hazardous materials/hazardous waste. Those substances defined as hazardous by the Comprehensive Environmental Response, Compensation, and Liability Act, as amended, and the Solid Waste Disposal Act, as amended, by the Resource Conservation and Recovery Act, as

amended. Generally, this includes substances that, because of their quantity, concentration, or physical, chemical, or infectious characteristics, may present substantial danger to public health or welfare, or the environment when released into the environment.

Historic sites. Under the National Historic Preservation Act, these are properties of national, state, or local significance in American history, architecture, archaeology, engineering, or culture, and worthy of preservation.

Holocene. The younger epoch of the Quaternary period; also referred to as the recent epoch.

Hydrocarbons. Any of a vast family of compounds containing hydrogen and carbon. Used loosely to include many organic compounds in various combinations; most fossil fuels are composed predominately of hydrocarbons. When hydrocarbons mix with nitrogen oxides in the presence of sunlight, ozone is formed; hydrocarbons in the atmosphere contribute to the formation of ozone.

Hydrology. A science dealing with the properties, distribution, and circulation of water both above and below the earth's surface.

Impacts/Effects. An assessment of the meaning of changes in all attributes being studied for a given resource; an aggregation of all the adverse effects, usually measured using a qualitative and nominally subjective technique. In this environmental impact statement, as well as in the CEQ regulations, the word impact is used synonymously with the word effect.

Indicator species. A species whose presence in a certain location or situation at a given population indicates a particular environmental condition. Their population changes are believed to indicate effects of management activities on a number of other species or water quality.

Ingrant. In this context, real estate and facilities outside the base boundary that are owned by agencies and private individuals, and made available for use by the Air Force through easement, license, permit, or lease.

Instrument Flight Rules (IFR). Rules governing the procedures for conducting instrument flight.

Kettle. A steep-sided, bowl-shaped hole or depression in glacial deposits, often containing a lake or a swamp, formed by the melting of a large, stagnant block of ice during glacial retreat; sediments are deposited around the ice so that a hole remains after the ice has melted.

Lead (Pb). A heavy metal used in many industries, which can accumulate in the body and cause a variety of negative effects. One of the six pollutants for which there is a national ambient air quality standard. See Criteria Pollutants.

Level of Service (LOS). In transportation analyses, a qualitative measure describing operational conditions within a traffic stream, and how they are perceived by motorists and/or passengers. In public services, a measure describing the amount of public services (e.g., fire protection, law enforcement services) available to community residents, generally expressed as the number of personnel providing the services per 1,000 population.

Loam, loamy. Rich, permeable soil composed of a mixture of clay, silt, sand, and organic matter.

Mast. Nuts, acorns, and similar products of hardwood species, which are consumed by animals.

Mean sea level (MSL). The average height of the sea surface if undisturbed by waves, tides, or winds.

Medical/biohazardous waste. Material that includes, but is not limited to, isolation wastes, infectious agents, human blood and blood products, pathological wastes, sharps (e.g., scalpels, needles), body parts, contaminated bedding, surgical wastes and potentially contaminated laboratory wastes, and dialysis wastes.

Metamorphic rock. Rock altered from some other form of rock by heat and/or pressure changing original textures, mineral content, and other geochemical characteristics of the rock. Metamorphism can be slight (minimal changes to the original rock) to extensive (complete destruction of original character of the rock).

Micron. A unit of length equal to one millionth of a meter; also called a micrometer. There are approximately 25,400 microns per inch.

Military operations area (MOA). Airspace area of defined vertical and lateral limits established for the purpose of separating certain training activities such as air combat maneuvers, air intercepts, and aerobatics from other air traffic operating under IFR.

Military training route (MTR). Airspace of defined vertical and lateral dimensions established for the conduct of military flight training at air speeds in excess of 250 knots.

Mineral. Naturally occurring inorganic element or compound.

Mitigation. A method or action to reduce or eliminate program impacts.

Mobile source. A moving source of air pollutants such as motor vehicle, airplane, train, or ship.

National Ambient Air Quality Standards (NAAQS). Section 109 of the Clean Air Act requires the U.S. Environmental Protection Agency (EPA) to set nationwide standards, the NAAQS, for widespread air pollutants. Currently, six pollutants are regulated by primary and secondary NAAQS: carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO_2), ozone (O_3), particulate matter (PM_{10}), and sulfur dioxide (SO_2). See Criteria Pollutants.

National Priorities List (NPL). A list of sites (federal and state) where release of hazardous materials may have occurred and may cause an unreasonable risk to the health and safety of individuals, property, or the environment.

National Register of Historic Places (NRHP). A register of districts, sites, buildings, structures, and objects important in American history, architecture, archaeology, and culture maintained by the Secretary of the Interior under authority of Section 2(b) of the Historic Sites Act of 1935 and Section 101(a)(1) of the National Historic Preservation Act of 1966, as amended.

Native Americans. Used in a collective sense to refer to individuals, bands, or tribes who trace their ancestry to indigenous populations of North America prior to Euro-American contact.

Native vegetation. Plant life that occurs naturally in an area without agricultural or cultivational efforts. It does not include species that have been introduced from other geographical areas and become naturalized.

National Environmental Policy Act (NEPA). P.L. 91-190, passed by Congress in 1969. The Act established a national policy designed to encourage consideration of the influences of human activities (e.g., population growth, high-density urbanization, industrial development) on the natural environment. NEPA also established the CEQ. NEPA procedures require that environmental information be made available to the public before decisions are made. Information contained in NEPA documents must focus on the relevant issues in order to facilitate the decision-making process.

Nitrogen dioxide (NO_2). Gas formed primarily from atmospheric nitrogen and oxygen when combustion takes place at high temperature. NO_2 emissions contribute to acid deposition and formation of atmosphere ozone. One of the six pollutants for which there is a national ambient standard. See Criteria Pollutants.

Nitrogen oxides (NO_x). Gases formed primarily by fuel combustion, which contribute to the formation of acid rain. Hydrocarbons and NO_x combine in the presence of sunlight to form ozone, a major constituent of smog.

Noise. Any sound that is undesirable because it interferes with speech and hearing, is intense enough to damage hearing, or is otherwise annoying (unwanted sound).

Noise attenuation. The reduction of a noise level from a source by such means as distance, ground effects, or shielding.

Noise contour. A line connecting points of equal noise exposure on a map. Noise exposure is often expressed using the DNL.

Nonattainment area. An area that has been designated by the U.S. EPA or the appropriate state air quality agency, as exceeding one or more National or State Ambient Air Quality Standards.

100-year floodplain. The area where there is a 1 percent probability of a flood in a given year.

Operating Location (OL). An organizational element of the Air Force Base Conversion Agency located at a closing base. The OL is responsible for the care and custody of closed areas of the base, disposal of real and related personal property, and environmental cleanup. This office is the primary point of contact for local community reuse organizations and the general public who deal with the disposal and reuse of the base.

Ordnance. Military supplies including weapons, ammunition, combat vehicles, and maintenance tools and equipment.

Outgrant. In this context, real estate and facilities on the base that are made available, by the Air Force, for use by another agency or a private individual through easement, license, permit, or lease.

Outwash. Stratified sand and gravel deposited by meltwater flowing from a glacier out beyond the extent of the ice flow. Generally forms thick sequences that form a plain (outwash plain) downslope from the glacier.

Outwash Plain. See Outwash.

Ozone (O_3) (ground level). A major ingredient of smog. Ozone is produced from reactions of hydrocarbons and nitrogen oxides in the presence of sunlight and heat. Some 68 areas, mostly

metropolitan areas, did not meet a December 31, 1987, deadline in the Clean Air Act for attaining the ambient air quality standard for ozone.

Patch cut. An even-aged management silvicultural system that results in removal of all timber in areas less than 5 acres and cut in an irregular shape.

PCB-contaminated equipment. Equipment that contains a concentration of polychlorinated biphenyls (PCBs) (see definition) from 50 to 499 parts per million (ppm) and is regulated by the U.S. EPA.

PCB equipment. Equipment that contains a concentration of PCBs of 500 ppm or greater and is regulated by the U.S. EPA.

Peak-hour volume. The number of vehicles passing a given section of roadway between 7:00 a.m. and 9:00 a.m. or between 4:00 p.m. and 6:00 p.m.

Permeability. The capacity of a porous rock or sediment to transmit a fluid.

Pesticides. Any substance, organic or inorganic, used to destroy or inhibit the action of plant or animal pests; the term thus includes insecticides, herbicides, fungicides, rodenticides, miticides, fumigants, and repellents. All pesticides are toxic to humans to a greater or lesser degree. Pesticides vary in biodegradability.

Physiographic province. A region in which all parts are similar in geologic structure and climate.

Physiography. The science of the surface of the earth and the inter-relations of air, water, and land.

Pleistocene. An earlier epoch of the Quaternary period during the "ice age" beginning approximately 3 million years ago and ending 10,000 years ago. Also refers to the rocks and sediments deposited during that time.

Point source. A stack or other highly localized pollutant source, as compared to an area source.

Polychlorinated biphenyls (PCBs). Any of a family of industrial compounds produced by chlorination of biphenyl. These compounds are noted chiefly as an environmental pollutant that accumulates in organisms and concentrates in the food chain with resultant pathogenic (disease-causing) and teratogenic (deformity-causing) effects. They also decompose very slowly.

Precambrian. The portion of the stratigraphic sequence of the earth's history prior to 570 million years ago.

Prehistoric. The period of time before the written record.

Prevention of Significant Deterioration (PSD). In the 1977 amendments to the Clean Air Act, Congress mandated that areas with air cleaner than required by NAAQS must be protected from significant deterioration. The Clean Air Act's PSD program consists of two elements: requirements for best available control technology on major new or modified sources, and compliance with an air quality increment system.

Prevention of Significant Deterioration Area. A requirement of the Clean Air Act that limits the increases in ambient air pollutant concentrations in attainment areas to certain increments, even though ambient air quality standards are met.

Prime farmland. Agricultural lands protected from conversion by the U.S. Department of Agriculture due to their optimal physical and chemical characteristics for production of crops.

Pulpwood. The wood of spruce, pine, aspen, and other trees used to make paper.

Radon. A naturally occurring, colorless, and odorless radioactive gas that is produced by radioactive decay of naturally occurring uranium.

Rare/protected species. A species that, although not presently threatened with extinction, is in such small numbers throughout its range that it may be endangered if its environment worsens.

Regeneration. The renewal of a tree crop by natural or artificial means; the actual seedlings and saplings existing in a stand.

Remediation. The process of removing or detoxifying environmental contamination.

Riparian. Of or on the bank of a natural course of water.

Rotation. The planned number of years between the formation of a generation of trees and their harvest at a specified stage of maturity.

Scarification. Loosening or exposing topsoil by mechanical means or by controlled fire in open areas to prepare for regeneration by direct seeding or natural seed fall.

Secondary employment. Additional employment generated in the region of influence by direct worker's spending of payrolls, and purchase of goods and services in the region by the reuse activities.

Sedimentary rock. Rock that is formed from deposits of pre-existing rocks, from deposits of the hard parts of organisms, or from salts deposited from solution.

Seismic Zone O. Area designated in the Uniform Building Code as having a very low potential risk for large seismic events.

Seismicity. Relative frequency and distribution of earthquakes.

Shelterwood system. A harvest method used in even-aged management involving removal of a stand of trees through a series of cuttings designed to establish a new crop, with seed and protection provided by a portion of the stands.

Shrink/swell potential. Volume change in soils possible upon wetting or drying.

Silvics. The natural science which deals with the laws underlying the growth and development of single trees and of the forest as a biological unit.

Silviculture. The theory and practice of controlling the establishment, composition, constitution, and growth of forests.

Site. As it relates to cultural resources, any location where humans have altered the terrain or discarded artifacts.

Skidder. A forest tractor which carries the wood load partly on the machine and the rest is skidded along the ground.

Skidding. Transporting trees or tree parts entirely off the ground by a terrain transport vehicle.

Slash. The residue left on the ground after felling, or accumulating there as a result of storm, fire, girdling, or poisoning.

Sludge. A heavy, slimy deposit, sediment, or mass resulting from industrial activity; solids removed from wastewater.

Snag. A standing dead tree used by birds for nesting, roosting, perching, courting, and/or foraging for food and by many mammals for denning and foraging for food.

Softwoods. A term for both the timber and the trees belonging to the group Gymnospermae.

Solid waste management unit (SWMU). Any discernible unit at which solid wastes have been placed at any time, irrespective of whether the unit was intended for the management of solid or hazardous waste. Such units include any area at a facility at which solid wastes have been routinely and systematically released.

Species of special concern. Defined by the Michigan Natural Features Inventory as a species that is rare and may become endangered or threatened in the future.

Stand. Referring to a stand of trees which is an aggregation of trees occupying a specific area and sufficiently uniform in composition, age arrangement, and condition to be distinguishable from the forest on adjoining areas.

State Historic Preservation Officer (SHPO). The official within each state, authorized by the state at the request of the Secretary of the Interior, to act as liaison for purposes of implementing the National Historic Preservation Act.

Sulfur dioxide (SO_2). A toxic gas that is produced when fossil fuels, such as coal and oil, are burned. SO_2 is the main pollutant involved in the formation of acid rain. SO_2 also can irritate the upper respiratory tract and cause lung damage. During 1980, some 27 million tons of SO_2 were emitted in the United States, according to the Office of Technology Assessment. The major source of SO_2 in the United States is coal-burning electric utilities.

Surplus property. Property designated as excess that is of no interest to any federal agency. These properties are made available to state, local, or nonprofit organizations or sold to private organizations.

Thermal cover. A condition where a dense vegetation conserves the amount of heat in an area.

Thinning. Cutting made in an immature crop or stand, primarily to accelerate the diameter increment (annual growth) of the residual trees, but also by suitable selection to improve the average form of the trees that remain.

Threatened species. Plant and wildlife species likely to become endangered in the foreseeable future.

Total suspended particulates (TSP). The particulate matter in the ambient air. The previous NAAQS for particulates was based on TSP levels; it was replaced in 1987 by an ambient standard based on PM_{10} levels.

Transfer. Deliver U.S. government property accountability to another federal agency.

Transition area. Controlled airspace extending 700 feet or more upward from the surface of the earth when designated in conjunction with an airport for which an approved instrument approach procedure has been prescribed; or from 1,200 feet or more above the surface of the earth when designated in conjunction with airway route structures or segments. Unless otherwise specified, transition areas terminate at the base of the overlying controlled airspace.

Understory. A layer of vegetation growing near the ground and beneath the canopy of a taller layer.

Uneven-aged. A forest stand composed of intermingling trees that differ markedly in age, usually by more than 10 to 20 years.

Unique farmland. Agricultural lands protected from conversion by the U.S. Department of Agriculture due to their value for production of specific or high economic value crops.

U.S. Environmental Protection Agency (U.S. EPA). The independent federal agency, established in 1970, that regulates federal environmental matters and oversees the implementation of federal environmental laws.

Utility systems. For purposes of this document, utility systems consist of water supply and distribution, wastewater collection and treatment, solid waste collection and disposal, and energy supply and distribution.

Visual flight rules. Rules that govern the procedures for conducting flight under visual conditions.

Volatile organic compounds (VOCs). Compounds containing carbon, excluding CO, CO_2, carbonic acid, metallic carbides, metallic carbonates, and ammonium carbonate.

Water Resources. Includes underground and surface sources of water for the area, and the quality of that water.

Wetlands. Areas that are inundated or saturated with surface water or groundwater at a frequency and duration sufficient to support a prevalence of vegetation typically adapted for life in saturated soil. This classification includes swamps, marshes, bogs, and similar areas. Jurisdictional wetlands are those wetlands that meet the hydrophytic vegetation, hydric soils, and wetland hydrology criteria under normal circumstances (or meet the special circumstances as described in the U.S. Army Corps of Engineers, 1987, wetland delineation manual where one or more of these criteria may be absent and are a subset of "waters of the United States").

Zoning. The division of a municipality (or county) into districts for the purpose of regulating land use, types of building, required yards, necessary off-street parking, and other prerequisites to development. Zones are generally shown on a map and the text of the zoning ordinance specifies requirements for each zoning category.

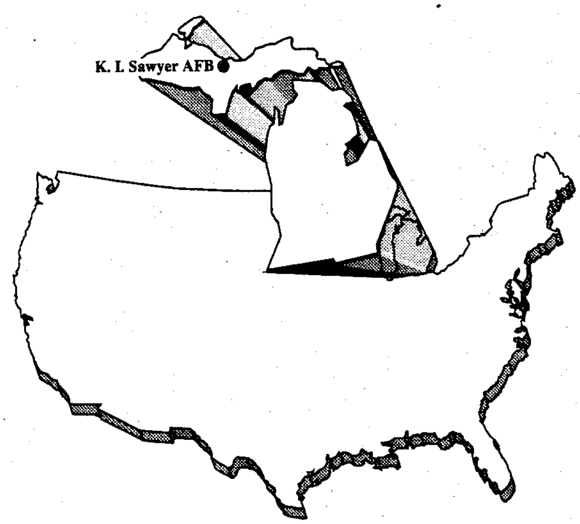
ACRONYMS/ABBREVIATIONS

AADT	average annual daily traffic
ACC	Air Combat Command
ACM	asbestos-containing material
ADT	average daily traffic
AFB	Air Force Base
AFBCA	Air Force Base Conversion Agency
AFI	Air Force Instruction
AGE	aerospace ground equipment
AHERA	Asbestos Hazard Emergency Response Act
AICUZ	Air Installation Compatible Use Zone
ALP	Airport Layout Plan
AOC	Area of Concern
APE	Area of Potential Effect
APZ	Accident Potential Zone
ARTCC	Air Route Traffic Control Center
ATC	air traffic control
BACT	best available control technology
BCT	Base Realignment and Closure (BRAC) Cleanup Team
BMP	best management practice
BNA	block numbering areas
BRAC	Base Realignment and Closure
CAA	Clean Air Act (federal)
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFA	Commercial Forest Act (Michigan)
CFR	Code of Federal Regulations
CO	carbon monoxide
CO_2	carbon dioxide
COCESS	Contract Operated Civil Engineering Supply System
COE	U.S. Army Corps of Engineers
CPSC	Consumer Product Safety Commission
CR	County Road
°F	degrees Fahrenheit
dB	decibel
DBCRA	Defense Base Closure and Realignment Act
DEIS	Draft Environmental Impact Statement
DERP	Defense Environmental Restoration Program
DLA	Defense Logistics Agency
DNL	day-night average sound level
DOI	Department of the Interior

DOD	Department of Defense
DOT	Department of Transportation
DRMO	Defense Reutilization and Marketing Office
EDMS	Emission and Dispersion Modeling System
EGADS	U.S. EPA Graphical Aerometric Data System
EIAP	environmental impact analysis process
EIS	Environmental Impact Statement
EOD	explosive ordnance disposal
EPA	Environmental Protection Agency
EPCRA	Emergency Planning and Community Right-to-Know Act
FAA	Federal Aviation Administration
FBO	Fixed Base Operator
FEIS	Final Environmental Impact Statement
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FPMR	Federal Property Management Regulations
FS	feasibility study
GSA	General Services Administration
HABS/HAER	Historic American Buildings Survey/Historic American Engineering Record
HAP	hazardous air pollutant
HARM	Hazard Assessment Ranking Methodology
HMTA	Hazardous Materials Transportation Act
HHS	Department of Health and Human Services
HUD	U.S. Department of Housing and Urban Development
IFR	instrument flight rules
ILS	Instrument Landing System
INM	Integrated Noise Model
IRP	Installation Restoration Program
kVA	kilovolt ampere
L_{dn}	day-night average sound level (DNL)
L_{eq}	equivalent sound level
LOS	Level of Service
LRA	Local Redevelopment Authority
MACT	maximum achievable control technology
MANG	Michigan Army National Guard
MDNR	Michigan Department of Natural Resources
MDNR-AQD	Michigan Department of Natural Resources - Air Quality Division
MERA	Michigan Environmental Response Act
MGD	million gallons per day
mg/l	milligrams per liter
$\mu g/m^3$	micrograms per cubic meter
mm	millimeter
MMCF	million cubic feet
MOA	military operations area

MSDS	Material Safety Data Sheet
MSL	mean sea level
MTR	military training route
MWH	megawatt-hours
NAAQS	National Ambient Air Quality Standards
NCP	National Contingency Plan
NCO	Noncommissioned Officer
NDI	Non-Destructive Inspection
NEPA	National Environmental Policy Act of 1969
NESHAP	National Emissions Standards for Hazardous Air Pollutants
NFADD	No Further Action Decision Document
NFMA	National Forest Management Act
NHPA	National Historic Preservation Act
nm	nautical mile
NO	nitric oxide
NO_2	nitrogen dioxide
N_2O	nitrous oxide
NOI	Notice of Intent
NO_x	nitrogen oxides
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NRHP	National Register of Historic Places
O_3	ozone
OL	Operating Location
OSHA	Occupational Safety and Health Administration
OU	Operable Unit
PA	Preliminary Assessment
PAPI	Precision Approach Path Indicator
PA/SI	Preliminary Assessment/Site Inspection
PCB	polychlorinated biphenyl
PCE	tetrachloroethylene
pCi/l	picocuries per liter
PHV	peak-hour volume
P.L.	Public Law
PM_{10}	particulate matter equal to or less than 10 microns in diameter
POL	petroleum, oil, and lubricants
ppm	parts per million
PR/VSI	Preliminary Review/Visual Site Inspection
PSD	Prevention of Significant Deterioration
RA	Remedial Action
RAB	Restoration Advisory Board
RAMP	Radon Assessment and Mitigation Program
RAPCON	radar approach control

RCRA	Resource Conservation and Recovery Act
RD	Remedial Design
RD/RA	Remedial Design/Remedial Action
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
ROI	Region of Influence
RPZ	runway protection zone
SAC	Strategic Air Command
SARA	Superfund Amendments and Reauthorization Act
SEL	sound exposure level
SH	State Highway
SHPO	State Historic Preservation Officer
SI	site inspection
SO_2	sulfur dioxide
SWMU	solid waste management unit
TCE	trichloroethylene
TD	Technology Development
TRACON	terminal radar approach control
TSCA	Toxic Substances Control Act
TSD	treatment, storage, or disposal
TSP	total suspended particulates
UPPCO	Upper Peninsula Power Company
U.S. #	U.S. Highway
U.S.C.	U.S. Code
USFWS	U.S. Fish and Wildlife Service
USGS	United States Geological Survey
UST	underground storage tank
VAQ	Visiting Airmen's Quarters
VFR	visual flight rules
VOC	volatile organic compound
VOQ	Visiting Officers' Quarters
VOR	very high-frequency omnidirectional range
VORTAC	very high-frequency omnidirectional range tactical air navigation
VPH	vehicles per hour
WAC	Wisconsin Administrative Code
WDNR	Wisconsin Department of Natural Resources
WS	Wisconsin Statutes
WWTP	wastewater treatment plant



APPENDIX B

APPENDIX B

NOTICE OF INTENT

APPENDIX B

NOTICE OF INTENT

The following Notice of Intent was circulated and published by the Air Force in the October 28, 1993, Federal Register in order to provide public notice of the Air Force's intent to prepare an Environmental Impact Statement of disposal and reuse of K. I. Sawyer Air Force Base, Michigan. This Notice of Intent has been retyped for clarity and legibility.

Please note: The point of contact for information on the disposal and reuse environmental impact statement has been changed. The new point of contact is:

William A. Myers, AICP
HQ AFCEE/ECP
3207 North Road
Brooks AFB, Texas 78235-5363
(210) 536-3668

NOTICE OF INTENT
TO PREPARE AN ENVIRONMENTAL IMPACT STATEMENT
FOR DISPOSAL AND REUSE OF SEVEN AIR FORCE BASES

The United States Air Force (Air Force) is issuing this notice to advise the public that the Air Force intends to prepare seven environmental impact statements (EISs) to assess the potential environmental impacts of disposal and reuse of the following bases identified for closure by Congress:

Gentile Air Force Station, Dayton, Ohio

Griffiss Air Force Base, Rome, New York

March Air Force Base, Riverside, California

Newark Air Force Base, Newark, Ohio

K. I. Sawyer Air Force Base, Marquette, Michigan

O'Hare International Airport Air Force Reserve Station, Chicago, Illinois

Plattsburgh Air Force Base, Plattsburgh, New York

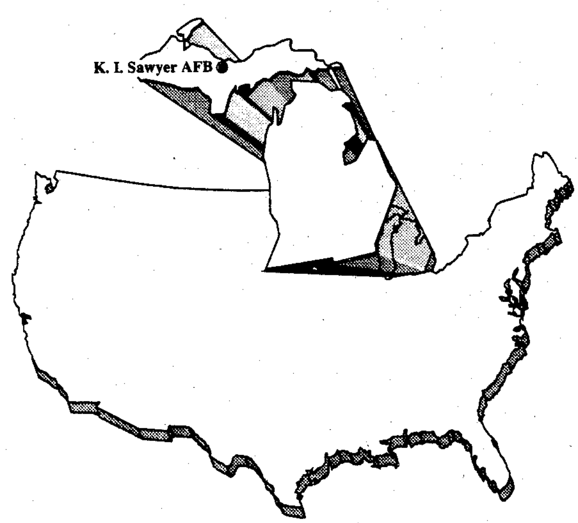
These EISs will address the potential environmental impacts of disposal of the property to public or private entities, as well as the potential environmental impacts of all reasonable reuse alternatives.

To provide a forum for public officials and the community to provide information and comments, scoping meetings will be held in each community beginning in November 1993 and continuing through late 1994. Notice of the times and locations of these meetings will be provided at a later date, and publicized in each community and in the Federal Register. The purpose of these meetings is to: (1) identify the environmental issues and concerns that should be analyzed to support base disposal and reuse; (2) solicit comments on the proposed action; and (3) solicit potential disposal and reuse alternatives for consideration in developing each EIS. In soliciting disposal and reuse alternatives, the Air Force will consider all reasonable alternatives offered by any federal, state or local government agency, and any federally-sponsored or private entity or individual. The resulting EISs will be considered in making disposal decisions that will be documented in the Air Force's Final Disposal Plan and Record of Decision for each base.

To ensure sufficient time to adequately consider public comments concerning environmental issues and disposal alternatives to be included in the EISs, the Air Force recommends that comments and reuse proposals be presented at the upcoming scoping meetings or forwarded to the address listed below at the earliest possible date. The Air Force will, however, accept additional comments at any time during the environmental impact analysis process.

Please direct written comments or requests for further information concerning the base disposal and reuse EISs to:

Lt. Colonel Gary P. Baumgartel
AFCEE/ESE
8106 Chennault Road
Brooks AFB, Texas 78235-5318
(210) 536-3869



APPENDIX C

APPENDIX C

DRAFT ENVIRONMENTAL IMPACT STATEMENT MAILING LIST

APPENDIX C

DRAFT ENVIRONMENTAL IMPACT STATEMENT MAILING LIST

This list of recipients includes interested federal, state, and local agencies and individuals who have expressed an interest in receiving the document. This list also includes the governor of Michigan, as well as United States senators and representatives and state legislators.

ELECTED OFFICIALS

Federal Officials

U.S. Senate

The Honorable Carl Levin
The Honorable Donald Riegle

U.S. House of Representatives

The Honorable Bart Stupak

State of Michigan Officials

Governor

The Honorable John Engler

State Legislature

The Honorable Dominic Jacobetti
The Honorable Don Koivisto

Regional/Local Officials

The Honorable Scott Pinkard
Mayor of Marquette

The Honorable Charles Vader
Mayor of Escanaba

GOVERNMENT AGENCIES

Federal Agencies

Administrative Services and Property Management
Office of the Secretary of Transportation

Advisory Council on Historic Preservation

Federal Agencies (Continued)

Bureau of Mines

Bureau of Prisons
Chief, Facilities Development and Operations

Center for Environmental Health and Injury Control
Special Programs Group (F29)

Council of Economic Advisors
Defense Technical Information Center

Department of Agriculture
Forest Service

Department of Commerce
Director, Economic Adjustment Division

Department of Commerce
Director, Office of Intergovernmental Affairs

Department of Education
Assistant to the Deputy Under Secretary for Intergovernmental and Interagency Affairs

Department of Energy
Division of Intergovernmental Affairs (CP-23)

Department of Health and Human Services
Office of Human Development Services

Department of Housing and Urban Development
Director, Community Management Division (CPD)

Department of the Interior
Director, Office of Environmental Affairs

Department of the Interior
National Parks Service

Department of the Interior
U.S. Fish and Wildlife Service

Department of Labor
Intergovernmental Affairs

Department of Transportation
Bureau of Aeronautics

Department of Veterans Affairs

Federal Agencies (Continued)

Environmental Protection Agency, Headquarters
Director, Office of Federal Activities

Farmers Home Administration
Deputy Administrator for Program Operations

Federal Aviation Administration
Director, Office of Environment and Energy

Federal Emergency Management Agency

General Services Administration
Assistant Commissioner for Real Estate Policy and Sales

Small Business Administration
Director, Office of Procurement

U.S. Army Corps of Engineers

Department of Defense

Department of Defense
Director, Office of Economic Adjustment

U.S. Air Force
Programs and Legislation Division

Regional Offices of Federal Agencies

Department of Agriculture
Huron National Forest
Forest Supervisor, Planning Group

Department of Housing and Urban Development
Director

Department of the Interior
U.S. Fish and Wildlife Service

Department of Transportation
Bureau of Aeronautics

Environmental Protection Agency, Region V
Chief, Planning and Environmental Review Branch

Federal Aviation Administration
Airports District Office
Belleville, Michigan

Regional Offices of Federal Agencies (Continued)

Federal Aviation Administration
Airports District Office
Des Plains, Illinois

Federal Aviation Administration
Air Route Traffic Control Center (ARTCC)
Manager

Federal Emergency Management Agency
Region V

General Services Administration
Office of Real Estate Sales

State of Michigan Agencies

Agricultural Department
Director

Bureau of History
State Historic Preservation Office

Central Upper Peninsula Planning and Development
Director

Corrections Department
Director

Department of Commerce
Director

Department of Labor
Director

Department of Natural Resources
Director

Department of Natural Resources
Forest Management Division

Department of Natural Resources
Region 11 Headquarters

Department of Public Health
Director

Department of Transportation
Director

State of Michigan Agencies (Continued)

Education Board
Director

Employment Security Commission
Director

Housing Development Authority
Director

K. I. Sawyer Base Conversion Authority
Chairperson

K. I. Sawyer Base Conversion Coordinator

Michigan Office of Federal Grants
Director

Office of Economic Development
Director

Social Services Department
Director

State Department
Secretary of State

State Policy Director and Counsel to the Cabinet

Water Resources Commission
Director

Local Government Agencies

Delta County Board of Commissioners
Chairman

Forsyth Township
Supervisor

Marquette County Board of Commissioners

Marquette County RMDD
Mr. Jim Kippola

Marquette Township
Supervisor

Negaunee Township
Supervisor

Local Government Agencies (Continued)

Sands Township
Supervisor

West Branch Township
Supervisor

Libraries

Escanaba Public Library

Forsyth Township Public Library

Ishpeming Carnegie Library

Marquette Public Library

Negaunee Public Library

Northern Michigan University, Lydia M. Olson Library

OTHERS

Other Organizations/Individuals

David P. Agee

Richard Aho

Bay Mills Executive Council

Harry A. Bryson

Delta County Chamber of Commerce

Philip A. Doepke

The Environmental Company, Inc.
Ms. Anne Tate

Environmental Defense Fund
Executive Director

Environmental Policy Center/Institute

Friends of the Earth

William H. Gray

Greater Ishpeming Chamber of Commerce

Other Organization/Individuals (Continued)

Great Lakes Mid-Atlantic Hazardous Substance Research Center
Dr. Walter J. Weber, Jr., Center Director

Great Lakes United, Region II
Mr. John Witzke
Regional Director

Scott R. Gygi

Hannahville Indian Community Council

Keweenaw Bay Tribal Council

Lac Vieux Desert Band of Lake Superior
Chippewa Indians of Michigan

Ronald Larson

Marquette Area Chamber of Commerce

Marquette County Airport

Marquette County Solid Waste Management Authority

John G. Meier

Michigan Air Force Association
Mr. William Stone, President

Michigan United Conservation Clubs, Inc.

Military Affairs Committee
Mr. Bruce Myles

National Audubon Society

National Audubon Society
Great Lakes Region

National Wildlife Federation

National Wildlife Federation, Region 7

Natural Resources Defense Council

The Nature Conservancy

The Nature Conservancy
East Lansing

Other Organization/Individuals (Continued)

Leland N. Nellist, Sr.

The Pathfinders

Ardeth Platte, O.P./Carol Gilbert, O.P.

Sault Ste. Marie Chippewa Tribal Council

Sierra Club

Sierra Club
Midwest Field Office

Tetra Tech, Inc.

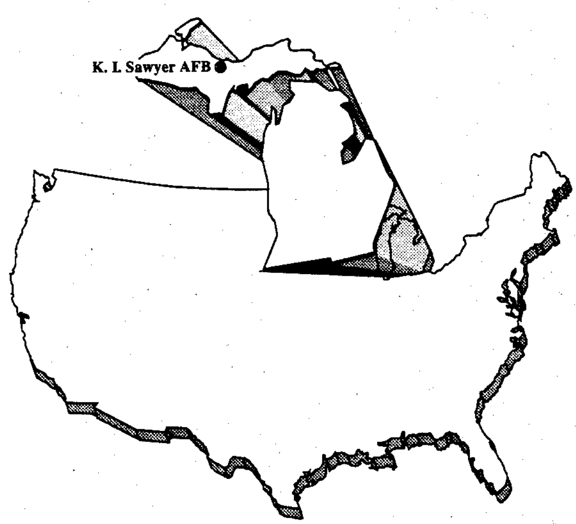
Upper Peninsula Environmental Coalition

Steven W. White

The Wilderness Society

The Wildlife Society
North Central Section

World Wildlife Fund



APPENDIX D

APPENDIX D

K. I. SAWYER AIR FORCE BASE INSTALLATION RESTORATION PROGRAM BIBLIOGRAPHY AND SITE DESCRIPTIONS

K. I. SAWYER AFB INSTALLATION RESTORATION PROGRAM (IRP) BIBLIOGRAPHY

Department of Defense, 1994. BRAC Cleanup Plan (BCP) K. I. Sawyer AFB, Marquette, Michigan.

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U.S. Air Force, 1991c. Decision Paper Sites OT-14 and OT-15, Hazardous Waste Storage Buildings 744 and 707, September.

U.S. Air Force, 1993. Community Relations Plan, K. I. Sawyer Air Force Base, Marquette Michigan, April.

U.S. Geological Survey, 1987. Installation Restoration Program Phase II Confirmation/ Quantification Stage I, Prepared for the U.S. Air Force.

Woodward-Clyde, 1992. Remedial Investigation/Feasibility Study OU-LF1, OU-LF2, OU-LF3, OU-LF4, and OU-HA2, K. I. Sawyer AFB, Michigan, U.S. Army Corps of Engineers, Omaha District, September.

INSTALLATION RESTORATION PROGRAM SITE DESCRIPTIONS

DRAINAGE POND NO. 1

Drainage Pond No. 1 (Site DP-01) is in the southern portion of the base immediately west of the Petroleum, Oil, and Lubricant (POL) Storage Area and east of Building 414. The site consists of an unlined infiltration basin approximately 4 feet wide, 15 feet long, and 2 feet deep that may have received shop wastes directly from Building 414, which was used as a jet engine test cell from the late 1950s to 1971, or through an oil/water separator connected to the floor drain of the building. The shop wastes may have included paints, solvents, and jet engine fuel.

Site DP-01 was identified during the 1985 Phase I - Records Search. During a site visit a black residue, possibly oil and fuel, was identified. Based on the presence of this residue, the highly permeable nature of the soils, and the close proximity to surface waters, the site received a Hazard Assessment Rating Methodology (HARM) score of 53. The site was then recommended for soil sampling as part of Phase II investigations.

Phase II, Stage 1 investigations were initiated in 1986 by the United States Geological Survey (USGS). Soil samples taken were analyzed for volatile organic compounds (VOCs) and total petroleum hydrocarbons (TPH). Only tetrachloroethylene was detected. Surface soils were later excavated; clean fill dirt was added and the area was revegetated.

A No Further Action Decision Document (NFADD) was submitted to Headquarters Strategic Air Command (HQ SAC) in August 1991. However, the site was reopened because the potential for groundwater contamination from Site DP-01 was not evaluated during previous studies. Since groundwater flows southeast from Site DP-01 to the adjacent POL Storage Area (Site ST-04), it is believed that any groundwater contamination from Site DP-01 would be masked by the POL-related contamination from Site ST-04; therefore, Site DP-01 was added to Operable Unit 1 (OU-1) in 1991. The extent of contamination, the risks to human health and the environment, and the final remedial actions will be determined by a Remedial Investigation (RI) (September 1994) and by a subsequent Feasibility Study (FS), which are under way and scheduled for completion in March 1995. This site was identified as Solid Waste Management Unit (SWMU) 13 during a Preliminary Review/Visual Site Inspection conducted in 1992 by the U.S. Environmental Protection Agency (EPA).

DRAINAGE POND NO. 2

Drainage Pond No. 2 (Site DP-02) is in the central part of the base, near the intersection of Avenue A-A and Fifth Street. The site consists of an unlined,

man-made infiltration basin, which covers approximately 1 acre. Site DP-02 was originally used as the outfall for storm drainage on base, receiving contaminated storm runoff from the Former Engine Repair Shop (Building 725) approximately 2,400 feet to the northwest, the flightline area, and other industrial facilities. From the early 1960s to 1976, wastes generated during routine engine maintenance at the Former Engine Repair Shop were discharged to floor drains that were connected to the base storm sewer system and ultimately to Site DP-02.

In the early 1980s, elevated levels of trichloroethylene (TCE) were detected in a proposed base drinking water supply well, east of the base hospital. As a result, this site was investigated during the 1985 Phase I - Records Search as a possible contamination source. Due to the quantities of industrial wastes discharged to the pond and the TCE detected in the groundwater, the site received a HARM score of 75. Installation of groundwater monitoring wells and pond sediment sampling were recommended as part of Phase II investigations.

Due to Phase II investigations initiated in 1986 and subsequent IRP investigations, over 150 groundwater observation wells have been installed in the central part of the base to characterize the extent of TCE in groundwater. A TCE plume, underlying an area of about 270 acres from the Former Engine Repair Shop southeastward to Silver Lead Creek, has been delineated. Site DP-02 is believed to be a source of this contamination and was placed in the Central Base TCE and Benzene Contamination Groundwater OU (OU-2). Other sites within OU-2 include SS-17, ST-18, and ST-19. Groundwater flow in the central portion of the base is in an east/southeast direction toward Silver Lead Creek. Concentrations of TCE in the plume range from about 1,800 micrograms per liter (μg/l) between Avenue B and the Former Engine Repair Shop in the northwest, to less than 2 μg/l in the southeast portion of the plume. The U.S. EPA maximum contaminant level (MCL) for TCE in drinking water is 5 μg/l. As an interim remedial action (IRA), a groundwater pump-and-treat system was installed in 1993 in the central portion of the base along Fifth Street; it became operational in June 1994. The effectiveness of the system to remove contamination from the groundwater will be evaluated to determine if the system should remain in place and/or be expanded to meet remediation goals. This site was identified as SWMU 14 during the Preliminary Review/Visual Site Inspection conducted by U.S. EPA in 1992.

DRAINAGE POND NO. 3

Drainage Pond No. 3 (Site DP-03) is in the northern part of the main cantonment area of the base, near the intersection of Avenue G and Eleventh Avenue. The site consists of a low-lying swampy and vegetated area approximately one-half acre in size. From 1957 to 1985, the pond received runoff from flightline facilities including Building 740 which was an

equipment maintenance wash rack. Waste streams may have included ethylene glycol (antifreeze), POL, fuels, and cleaning compounds. Currently, wastes from this building are recycled or disposed of off site. Specific information regarding waste disposal practices before 1982 is unavailable.

Site DP-03 was identified during the 1985 Phase I - Records Search. The site received a HARM score of 64, due to the quantity and unknown nature of the runoff it received, the high permeability of the soils, and the site's proximity to surface water. Installation and sampling of groundwater monitoring wells were recommended as part of Phase II investigations.

Site DP-03 was not included in the Phase II, Stage 1 hydrologic investigations conducted in 1986 and 1987. However, during Phase II, Stage 2, the USGS installed three groundwater monitoring wells near the site. Groundwater was analyzed for aromatic and halogenated VOCs, and phenols. Trace concentrations of phenol, 1,2-dichloroethane, and tetrachloroethylene (less than 1 μg/l each) were detected in the upgradient as well as downgradient wells. No on-site soil or surface water investigations were performed.

Additional characterization and investigation of Site DP-03 was performed during fiscal year (FY) 1993. The extent of contamination and the risks to human health and the environment have been detailed in a draft RI/FS. The final remedial action was conducted in summer 1994 and the top 3 feet of soil was removed and disposed of at Landfill No. 4 (Site LF-11). An NFADD has been submitted to the regulators; additional groundwater sampling will be conducted during summer 1995 prior to site close-out. This site was identified as SWMU 15 during the Preliminary Review/Visual Site Inspection conducted by U.S. EPA in 1992.

PETROLEUM, OIL, AND LUBRICANTS STORAGE AREA

The POL Storage Area (Site ST-04), in the southern part of the base adjacent to Avenue D, has been operating since the late 1950s. The site consists of five aboveground steel bulk storage tanks; each tank is surrounded by a concrete-lined earthen berm containment area. Three tanks contain jet propulsion fuel (JP-4), which is received via pipeline; one tank contains deicing fluid; and one tank is empty. Since 1970, five documented spills of JP-4 have occurred at Site ST-04. It is estimated that a total of 65,000 to 74,000 gallons of fuel have been spilled at the site since 1970, resulting in soil and groundwater contamination. Spills before 1970 were not documented.

Site ST-04 was identified during the 1985 Phase I - Records Search. Due to the quantities and number of known releases on site, the high permeability of the soils, and close proximity of groundwater, the site received a HARM score of 75. Installation of groundwater monitoring wells to better define

the extent of contamination was recommended as part of Phase II investigations.

Extensive soil and groundwater sampling was performed between 1987 and 1990 as part of the USGS Phase II, Stage 1 and Stage 2 groundwater characterization investigations. Twenty-four soil borings were sampled at three depths and analyzed for aromatic VOCs and TPH. Benzene, toluene, and xylenes were detected at concentrations above action levels, as was TPH. A soil gas survey was conducted to determine the optimal locations for groundwater monitoring wells at Site ST-04.

In 1987, 64 groundwater monitoring wells were installed in the local aquifer to determine the extent of groundwater contamination at Site ST-04 and define the extent of free product present on the water table. Groundwater in this portion of the base flows in a southeast direction. Groundwater samples collected from 1988 to 1990 contained high concentrations of benzene, toluene, and xylenes.

Free product (JP-4) was observed in approximately 20 wells that define a plume originating from the southeast corner of Site ST-04. The plume appears to be migrating southeastward toward Silver Lead Creek. Free product thickness in the wells varied from a thin film of hydrocarbon to 2.4 feet. (Note: The thickness of product in wells varies substantially from actual thickness of product on the water table. A thickness of 2.5 feet in a well may represent a thickness of approximately 6 inches on the water table.)

As a result of groundwater level measurements and surface water sample results, contaminated groundwater has been found to be flowing to Silver Lead Creek. Additionally, based on the results of previous investigations, benzene has been detected in Silver Lead Creek downstream from where the plume discharges at levels ranging from non-detect to 7.5 parts per billion.

From November 1990 to January 1991, a pilot-scale study/IRA was conducted at Site ST-04. This study evaluated the effectiveness of two systems to recover floating hydrocarbons from the groundwater surface. Over 275 gallons of JP-4 were recovered during this study.

Site ST-04 is part of OU-1, which was established in 1991 and includes sites DP-01 and SS-05. A pilot-scale study on soil remediation by bioventing is under way at Site ST-04. Site closeout will not take place until an RI/FS, which began in spring 1994, has been performed. The anticipated final remedial action plan is a combination of bioventing, a passive pumping system to remove fuel from the water table, and a pump-and-treat system to remove/treat contaminated groundwater. Provided funding is available, all systems are scheduled to be in place in 1997. This site was identified as

SWMU 4 during the U.S. EPA Preliminary Review/Visual Site Inspection conducted in 1992.

A JP-4 free product removal system was placed in operation in summer 1994. JP-4-contaminated water is skimmed from the water table, run through an oil/water separator and a carbon filtering system, and discharged to the sanitary sewer system for additional treatment.

DEFENSE REUTILIZATION AND MARKETING OFFICE (DRMO) STORAGE YARD

The Defense Reutilization and Marketing Office (DRMO) Storage Yard (Site SS-05) is in the southern portion of the base, east of Site ST-04. The site consists of a flat, asphalt-covered, open storage area approximately 325 feet long and 205 feet wide. The area has been used as a hazardous waste storage area since 1980. Prior to 1980, waste oil was stored in a sandy area of the yard. As many as 60 drums were stored in this location on some occasions, and many may have leaked. Polychlorinated biphenyl (PCB)-containing transformers were also stored in the area prior to final disposal. Area runoff flows off site to the surrounding grass area.

This site was identified during the 1985 Phase I - Records Search. Because of the highly permeable soils on site, the surface water flow toward Silver Lead Creek, and the possible on-site contamination due to the release of hazardous wastes, the site received a HARM score of 50. Soil sampling was recommended as part of Phase II investigations.

In 1986, several groundwater monitoring wells were installed by the USGS in the vicinity of Site SS-05 during the Phase II, Stage 1 investigations. In 1987, soil samples were analyzed for organochloride pesticides/PCBs, oil, and grease. No surface soil samples were taken. During these investigations, the only constituents detected in the soil samples were oil and grease. None of the other analytes were detected.

A decision document was submitted to HQ SAC in August 1991 recommending no further action for Site SS-05. However, since the groundwater at this site is contaminated with POL, the site has been reopened. Site SS-05 was included as part of the POL Storage Area OU (OU-1), and all future investigations or remedial actions for the site will be in conjunction with Site ST-04 activities as part of OU-1. An RI/FS for OU-1 was conducted in 1994. This site has been identified as SWMU 3 following a Preliminary Review/Visual Site Inspection conducted by the U.S. EPA in 1992.

FIRE TRAINING AREA NO. 1

Fire Training Area No. 1 (Site FT-06) is near the northern end of the primary taxiway in the northern part of the base. The site consisted of an unlined

pit of unknown size that was used for fire fighting training exercises from approximately 1958 to the early 1970s. During training exercises, 55-gallon drums of waste fuel, POL, paints, thinners, degreasers, and hydraulic fluids (stored adjacent to the site) were emptied onto the soil and ignited. Training fires were extinguished with water, protein foam, and carbon dioxide. Exercises were conducted approximately four times per month, using an estimated 300 to 2,000 gallons of waste per exercise. Pre-wetting of the soil was not a routine practice, and no attempt was made to collect unburned fuel or separate the wastes from water after the training exercises.

This site was identified during the 1985 Phase I - Records Search. Due to the quantities of known wastes burned on site, the highly permeable soils, and the site's proximity to Big Creek, the site received a HARM score of 60. Installation of groundwater monitoring wells and soil sampling were recommended as part of Phase II investigations to determine the extent of contamination.

In 1988, three groundwater monitoring wells were installed in the aquifer beneath Site FT-06 as part of USGS Phase II, Stage 1 hydrologic investigations; three additional wells were installed in 1990. Groundwater samples were analyzed for aromatic and halogenated VOCs, lead, and TPH. A trace amount of lead was detected in one sample and a concentration of 210 milligrams per liter (mg/l) of TPH was detected in one sample. All TCE levels detected during both rounds of sampling were below action levels. Trace amounts of 1,1,1-trichloromethane were detected in two 1988 samples and all three 1990 samples. Benzene was not detected in 1988; however, two 1990 samples contained benzene above action levels. Groundwater in this area flows in an eastward direction toward the base boundary.

Soil samples were also collected during well installation. Two samples contained elevated concentrations of ethylbenzene, toluene, and xylenes.

In 1993, a pilot-scale bioventing system for removal of organics was installed as an IRA. This removal action was implemented to determine system effectiveness.

The final remedial action selected for this site will depend on the results of an RI (September 1994) and an FS scheduled for completion in 1995. This site was identified as SWMU 6 during the Preliminary Review/Visual Site Inspection conducted in 1992 by U.S. EPA.

FIRE TRAINING AREA NO. 2

Fire Training Area No. 2 (Site FT-07) is in the northeastern part of the base immediately north of the new control tower (Building 747), east of the primary taxiway. The site consists of an octagonal concrete pad

approximately 75 feet wide bordered by a 6-inch high concrete berm. From the early 1970s until 1990 this area was used for approximately three to four training exercises per month; an estimated 300 to 500 gallons of pure JP-4 were used as the ignition source during each exercise. Fires were extinguished with protein foam, carbon dioxide, aqueous film-forming foam, chlorobromomethane, and water. Until 1982, there was no pre-wetting of the site and no unburned fuel recovery. In 1982, a concrete pad was constructed and a fuel-water drain system was installed to drain any liquids remaining on the pad to an oil/water separator. The fuel collected was then burned off and the remaining water was discharged to a nearby underground leach bed.

This site was identified during the 1985 Phase I - Records Search. The site received a HARM score of 55 due to the quantities of waste discharged to the site, the duration of fire training exercises, and the permeability of the soil. Soil sampling and the installation and sampling of groundwater monitoring wells were recommended as part of Phase II investigations to define the extent of contamination.

Samples taken in 1988 from three groundwater monitoring wells installed into the aquifer beneath Site FT-07 were analyzed for organic compounds. Benzene, toluene, and TCE were detected in concentrations above action levels. Samples from eight additional wells, which were installed in 1989 downgradient from Site FT-07, contained concentrations of organic compounds believed to be a result of fuel contamination. Chemical analyses of groundwater samples from 1988, 1989, and 1990 suggest that these concentrations are decreasing.

In August 1991, a leaking underground storage tank (UST) and associated plumbing were removed from the site and approximately 500 cubic yards of petroleum-contaminated soil were removed. Contamination at Site FT-07 is believed to be the combined result of discharges from the leaking UST and fire training exercises.

In 1993, a pilot-scale bioventing system for removal of organics was installed as an IRA. This removal action was implemented to determine system effectiveness. The final remedial action selected will depend on the results of an RI (September 1994) and an FS currently scheduled for 1995. This site was identified as SWMU 7 during the Preliminary Review/Visual Site Inspection conducted by U.S. EPA in 1992.

LANDFILL NO. 1

Landfill No. 1 (Site LF-08) is in the southern portion of the base, immediately south of the weapons storage area. The site consists of an approximately 21-acre landfill where construction waste was burned on a daily basis from 1955 to 1957. From 1963 to 1973, the landfill was used to dispose of

wastes such as paints, solvents, acids, fertilizer, asphalt, asbestos, household refuse, fly ash, hardfill, and sludge, which were covered with soil daily. In addition, about 50 drums of dichlorodiphenyl trichloromethane (DDT) may have been disposed of at the site sometime before 1970. The existence or location of the DDT-containing drums could not be verified, although large metal objects were detected at seven locations at the landfill during a ground-penetrating radar survey conducted in October 1989. No DDT has been detected in groundwater downgradient from Site LF-08.

This site was identified during the 1985 Phase I - Records Search. Due to the introduction of liquid wastes in trenches up to 40 feet deep, as well as the high permeability of the soils, a HARM score of 71 was assigned to this site. Installation of groundwater monitoring wells and sampling of surface water and soils were recommended as part of Phase II investigations.

The USGS began the Phase II, Stage 1 hydrologic investigations in 1986, when two groundwater monitoring wells were installed in the aquifer in the vicinity of Site LF-08. Groundwater in this area flows in an east to southeast direction toward Silver Lead Creek and Stump Lake. Samples analyzed for organic compounds were found to contain hydrocarbons and compounds characteristic of fuels in the groundwater.

During the Phase II, Stage 2 investigation conducted in 1988, four additional monitoring wells were installed at Site LF-08. Vinyl chloride was the only constituent detected in the groundwater samples in excess of the U.S. EPA drinking water standard.

Surface water and sediments from Stump Lake and Silver Lead Creek were also sampled and analyzed during the Phase II, Stage 2 investigation. Most analytes were not detected or were below MCLs, except for a single surface water sample from Silver Lead Creek, which had vinyl chloride at a concentration of 2.2 μg/l (the MCL is 2.0 μg/l).

Site LF-08 was included in the RI/FS and Baseline Risk Assessment conducted by the U.S. Army Corps of Engineers (COE) in 1992 for the base landfills. Groundwater from one upgradient and seven downgradient wells was sampled and analyzed for VOCs, base neutral/acid extractables (BNAs), pesticides/PCBs, and heavy metals. Results indicated some VOCs and BNAs below action levels were present in the groundwater downgradient of Site LF-08. The groundwater sampling revealed no detectable amounts of vinyl chloride. A total of 17 metals were detected in groundwater upgradient and downgradient of Site LF-08, and concentrations of 14 of these metals increased downgradient of Site LF-08.

Three surface water samples were collected from Silver Lead Creek and Stump Lake, east of Site LF-08, during the RI. The draft RI reported that Stump Lake surface water quality did not appear to be affected by the

landfill. However, surface water was not analyzed for metals during this investigative stage.

A supplemental RI/FS is under way; final remedial actions for LF-08 will be based on the results of the FS scheduled for completion in November 1995. Site LF-08 was identified as SWMU 8 during the Preliminary Review/Visual Site Inspection conducted by U.S. EPA in 1992.

LANDFILL NO. 2

Landfill No. 2 (Site LF-09) is in the southern portion of the base, northeast of the intersection of Freedom Boulevard and Scorpion Street. The site consists of a landfill covering approximately 3 acres, which was in operation from 1955 until 1962. Site LF-09 was used for only a short time due to a lack of cover material, as well as its inaccessibility. For the first 2 years of operation, this landfill was used to dispose of hardfill generated during base construction. After 1957, capacitors, household refuse, shop waste, and transformers, along with fly ash from the Central Heating Plant, were discarded at the site. The site is now covered with hardfill, grass, and sand.

Site LF-09 was identified during the 1985 Phase I - Records Search. The site received a HARM score of 67 due to the swampy nature of the area, its proximity to groundwater, and the nature of the wastes disposed of there. Installation of groundwater monitoring wells and sampling of surface water and soils were recommended as part of Phase II investigations.

In 1988, five groundwater monitoring wells were installed at Site LF-09 and one round of sampling was conducted. Phenol was detected above action levels in only one well; none of the other samples had constituents in excess of their MCLs. Groundwater beneath Site LF-09 flows eastward to Silver Lead Creek.

During the Phase II, Stage 2 investigation, three surface water samples were collected from Silver Lead Creek near Site LF-09. Trace amounts of vinyl chloride were detected in all three samples; no other contaminants were detected. The Phase II, Stage 2 report concluded that the vinyl chloride most likely originated from Site LF-08.

Site LF-09 was included in the 1992 RI/FS and Baseline Risk Assessment conducted by the COE for the base landfills. Groundwater from one upgradient well and four wells immediately adjacent to Silver Lead Creek on the downgradient (east) side of the landfill was sampled and analyzed for VOCs, BNAs, pesticides/PCBs, and target analyte list (TAL) metals during the RI. Results indicated the presence of VOCs and metals at concentrations below action levels. Metals were found in the highest concentrations in downgradient monitoring wells that penetrate directly through a portion of the fly ash material disposed of at Site LF-09.

The RI included collection of two downgradient and one upgradient surface water samples from Silver Lead Creek near Site LF-09. These samples were analyzed for VOCs and BNAs; only two BNA analytes were detected.

A supplemental RI/FS is currently under way; final remedial actions for Site LF-09 will be based on the results of the FS scheduled for completion in November 1995. This site was identified as SWMU 9 during a 1992 Preliminary Review/Visual Site Inspection conducted by U.S. EPA.

LANDFILL NO. 3

Landfill No. 3 (Site LF-10) is north of the main industrial area at the northern end of Avenue B. The site consisted of a single east-west oriented trench that was 14 feet wide, 400 feet long, and 30 feet deep. Site LF-10 was used from the early 1970s to 1975, primarily for disposal of household waste, sewage sludge, and small amounts of drummed industrial wastes. The site is now covered with trees approximately 15 to 20 feet tall, making determination of the exact dimensions difficult. It is estimated to cover about 5 acres.

Site LF-10 was identified during the 1985 Phase I - Records Search. It received a HARM score of 75 due to its proximity to groundwater, the permeability of the soils, and the nature and the quantities of the wastes disposed of there. Installation of groundwater monitoring wells and pond sediment sampling were recommended as part of Phase II investigations.

Between 1986 and 1991, groundwater samples from four wells were collected at Site LF-10. Groundwater in this area flows in an east to northeast direction toward the base boundary. Samples collected in 1985 contained trace amounts of organics that were below their respective MCLs for drinking water. In 1988, trace amounts of 1,1,1-trichloromethane were detected in a new monitoring well installed downgradient of Site LF-10. No other analytes were detected.

In 1992, Site LF-10 was investigated as part of the 1992 RI/FS and Baseline Risk Assessment conducted by the COE for the base landfills. During summer 1993, additional downgradient groundwater monitoring wells were installed.

A supplemental RI/FS is under way; final remedial actions for LF-10 will be based upon the results of the FS scheduled for completion in November 1995. Closure plans are expected to include post-closure monitoring and upgraded institutional controls such as fencing, deed restrictions, and warning signs. This site was identified by U.S. EPA as SWMU 10 following a 1992 Preliminary Review/Visual Site Inspection.

LANDFILL NO. 4

Landfill No. 4 (Site LF-11) is in the northern part of the base immediately south of the Explosive Ordnance Disposal range and northwest of Site LF-10. The site covers an area of approximately 40 acres and contains several north-south trending trenches that are 400 feet long, 10 feet wide, and 25 feet deep, in addition to extensive surface debris. Site LF-11 was operated as the principal waste disposal area at the base from 1975 to 1989. Waste discarded at the site were similar to those wastes disposed of at the other base landfills including refuse from base operations and residential housing, and undigested sewage sludge.

This site was identified during the 1985 Phase I - Records Search. Due to the uncertainty behind the types and quantities of the wastes discharged to this site and the permeability of the soils, the site received a HARM score of 54. Installation of groundwater monitoring wells and sampling of surface waters and soils were recommended as part of Phase II investigations.

From 1986 to 1988, the USGS installed and sampled groundwater from several wells in the vicinity of Site LF-11 as part of a hydrogeologic survey. Groundwater samples from the wells at Site LF-11 were analyzed for organic compounds, trace metals, total dissolved solids (TDS), and some inorganic constituents. Fourteen VOCs were detected at low concentrations. Inorganics were detected below action levels, with the exception of TDS, fluoride, and iron at one well. Groundwater beneath Site LF-11 flows in a northeast to east direction toward the base boundary. Surface water and sediment samples from two sites at Big Creek were analyzed for organic and inorganic constituents. No organics were detected, and inorganics were below action levels.

In 1992, Site LF-11 was included in the RI/FS and Baseline Risk Assessment conducted by the COE for the base landfills. During the RI, groundwater from three USGS monitoring wells, two COE wells, and a well previously installed by the Air Force was sampled for target compound list (TCL) VOCs, BNAs, pesticides/PCBs, and TAL metals. Groundwater downgradient of Site LF-11 was found to contain VOCs, BNAs, and heavy metals. The draft RI reported the presence of a contaminant plume in groundwater downgradient of Site LF-11. Surface water samples were collected from three locations adjacent to Big Creek, north of Site LF-11, and were analyzed for TCL, VOCs, and BNAs. The draft RI reported that the surface water quality downgradient of Site LF-11 does not appear to be affected by landfill activities.

A geophysical study was conducted at Site LF-11 prior to landfill capping so that the trench boundaries can be more clearly delineated and capping costs can be minimized.

The RAs selected for cost estimate purposes for Site LF-11 include a landfill cap, regrading, revegetation, and post-closure monitoring. It is anticipated that the capped area will be a minimum of 40 acres. After the remedial measures are in place, Site LF-11 will be closed as an unlicensed municipal landfill. U.S. EPA identified this site as SWMU 11 during a 1992 Preliminary Review/Visual Site Inspection.

HARDFILL AREA NO. 2

Hardfill Area No. 2 (Site LF-12) is in the southwest part of the base, approximately 500 feet north of the Main Gate. The site consists of an area approximately 75 feet by 170 feet that was used for disposal of hardfill and as a storage area for transformers, some of which contained PCBs. The site was in operation from the early 1960s to 1970. The site has now revegetated with small pine trees.

Site LF-12 was identified during the 1985 Phase I - Records Search. Due to the possibility of PCB contamination and the highly permeable nature of the soil, the site received a HARM score of 55. Soil sampling was recommended as part of Phase II investigations.

The USGS conducted subsurface soil sampling for organochloride pesticide/ PCB analysis. No organic compounds were detected; there was also no visual evidence of contamination. The USGS prepared the site for closure by preparing a draft decision document recommending that no further remedial actions were needed for Site LF-12. This recommendation, however, was not accepted since no surface soils had been sampled, and PCBs are relatively immobile in the environment. More than 20 surface samples were collected in 1991 and analyzed for pesticides and PCBs; none were found to contain PCBs. Because Site LF-12 is not known to have received hazardous wastes, and the results of surface soil sampling indicated no PCBs on site, an additional NFADD was submitted to HQ Air Combat Command (ACC) in 1992. Site LF-12 was closed out in spring 1994 upon U.S. EPA and MDNR approval of the NFADD submitted in 1992. This site was identified by U.S. EPA as SWMU 12 following the 1992 Preliminary Review/Visual Site Inspection.

BUILDING 744

Building 744 (Site OT-14) is in the northern portion of the main industrial area at the end of Avenue G. The facility was constructed in 1962 and consists of a 12-foot square concrete pad equipped with an 18-inch high concrete dike without floor drains. The facility was used as a test cell for B-52 and KC-135 engines until the early 1970s. The building remained empty until 1979, when it was designated a storage area for PCB-containing transformers and other exterior electric equipment prior to removal by a

licensed transporter for disposal off base. A small portion of Building 744 is now used for hazardous waste storage.

This site was inspected during the 1985 Phase I - Records Search, but since there was no evidence that a PCB release had occurred, the site was excluded from further evaluation. For this reason, Site OT-14 was not scored using the HARM criteria or recommended for study during Phase II investigations.

However, during the USGS Phase II, Stage 1 hydrologic investigations conducted in 1986 and 1987, a groundwater monitoring well was installed downgradient of Site OT-14. The well was sampled for organic compounds and all results were below detection limits.

No further action was recommended for Site OT-14, since no environmental contamination associated with activities at the building was suspected. An NFADD for Sites OT-14 and OT-15 was submitted to HQ SAC in September 1991, and the site was approved for closure by the Air Force in 1992. Site OT-14 was closed out in spring 1994 upon U.S. EPA and MDNR approval of the NFADD. This site was identified as SWMU 1 during the Preliminary Review/Visual Site Inspection conducted by U.S. EPA in 1992.

BUILDING 707

Building 707 (Site OT-15) is in the northern portion of the industrial area near the intersection of Avenue D and Seventh Street. This facility was used as a storage shed from approximately the mid-1960s until 1992. The building was approximately 20 feet by 10 feet and was constructed in 1958 to house a drinking water supply well (AF3), which was abandoned around 1963. Between 1965 and 1966, the water pumps and all well-related equipment were removed and a steel cap was welded over the well casing. From the mid-1960s to approximately 1980, insecticides, including DDT, were stored at this facility; and from 1980 to 1992, acetylene gas and propane cylinders were stored there. Building 707 was demolished in June 1992.

This site was inspected during the 1985 Phase I - Records Search, but since no evidence of a release was found, the site was excluded from further evaluation. For this reason, Site OT-15 was not scored using the HARM criteria or recommended for study during Phase II investigations.

During the Phase II, Stage 1 hydrologic investigations conducted by the USGS, water well AF3 was sampled for organic and inorganic chemicals; all chemicals were below detection limits. In 1991, well AF3 was decommissioned and filled with cement grout.

No further action was recommended for Site OT-15, since no environmental contamination associated with activities at the building was suspected. An NFADD for Sites OT-14 and OT-15 was submitted to HQ SAC in September 1991, and the site was approved for closure by the Air Force in 1992. Site OT-15 was closed out in spring 1994 upon U.S. EPA and MDNR approval of the NFADD.

SOIL REMEDIATION AREA

The Soil Remediation Area (Site ST-16) is in the southern portion of the base, between the Former Fighter Alert Hangar (Building 400) and an Aircraft Support and Storage facility (Building 402). The site is a soil stockpile area containing approximately 6,300 cubic yards of petroleum-contaminated soil removed during the basewide UST removal and replacement project.

Prior to the basewide UST removal and replacement project, base personnel conducted a Preliminary Assessment in which the location, content, and volume were identified for each UST on base. During tank removals and replacements, field screening equipment was used to qualitatively assess the degree of contamination at each UST excavation site. All soil showing the presence of VOCs above the detection limit of the field screening device was excavated and stockpiled at Site ST-16 for thermal treatment.

All regulated USTs on K. I. Sawyer AFB were included in a basewide UST removal/replacement program in order to comply with the requirements of 40 Code of Federal Regulations (CFR) 280. The basewide removal/replacement program started in FY 1991 and was completed at the end of calendar year 1992. All new USTs installed under the basewide program have double-walled tanks, leak detection, and corrosion protection, in accordance with federal regulations.

Approximately 6,300 cubic yards of petroleum-contaminated soil were removed during the basewide UST removal/replacement program and stockpiled at Site ST-16. State regulations require this soil to be disposed of as a Type II solid waste or remediated to remove all organic contaminants. Since the county landfill does not accept petroleum-contaminated soils, and because Type II solid wastes cannot be transported out of the county, the selected remedial action for this petroleum-contaminated soil was to remediate on site by installing a low-temperature thermal treatment unit. Following treatment, the soil was sampled and the clean soil was disposed of at Site LF-11.

Thermal treatment of contaminated soils was completed in spring 1994; however, additional contaminated soil may be stored at this site as a result of future storage tank remedial actions. Following completion of all soil

removal/remediation activities, site closure documents will be prepared and submitted for regulator approval.

AVENUE G JP-4 SPILL

The Avenue G JP-4 Spill (Site SS-17) is along the northern flightline area and consists of soil and groundwater contaminated with benzene, JP-4, and toluene. A groundwater contamination plume originates along an underground JP-4 fuel line, which parallels Avenue G and the SAC Operational Apron near the Former Engine Repair Shop (Building 725). The Site SS-17 groundwater contamination plume is partially commingled with the northernmost portion of the Site DP-02 TCE plume.

A groundwater plume contaminated with benzene, believed to originate in the vicinity of Avenue G, was first detected during a 1990 hydrology investigation conducted by the USGS. Numerous monitoring wells were installed in the central part of the base as part of the USGS study, with groundwater samples showing the highest concentrations of benzene along an 1,800-foot strip east (downgradient) of the buried JP-4 line near Avenue G. Elevated concentrations of benzene and toluene were detected in two monitoring wells along this area. Fuel was also detected on top of the water table (0.16 foot) in one monitoring well located along the JP-4 line; however, fuel was not detected during a subsequent check in 1991.

Site SS-17 was added to the K. I. Sawyer AFB IRP in 1992 during the basewide UST removal/replacement project. Four 2,000-gallon waste fuel USTs associated with the Avenue G JP-4 line were removed and replaced. The tanks were originally installed in 1958. Petroleum-contaminated soil was encountered during the UST removal operations and approximately 630 cubic yards of contaminated soil were removed to Site ST-16 for thermal treatment. However, due to the depth of the contamination, not all contaminated soil was removed from the site. This prompted the inclusion of this site into the Central Base TCE and Benzene Groundwater Contamination OU (OU-2) in 1991. OU-2 sites will undergo an RI/FS, scheduled for spring 1996, to better define the extent and type of contamination and evaluate remediation technologies.

As an IRA, a groundwater pump-and-treat system was installed in the central portion of the base along Fifth Street in 1993 and became operational in June 1994. The system's effectiveness in removing contamination from the groundwater will be evaluated to determine if the system should remain in place and/or be expanded to meet remediation goals. Site SS-17 is undergoing a supplemental RI/FS, which is scheduled for completion by fall 1995. Additional investigations to identify the source of groundwater contamination were initiated in summer 1994.

BASE EXCHANGE SERVICE STATION USTs

The Base Exchange (BX) Service Station (Building 826) (Site ST-18) is in the central part of the base on Avenue A. In 1985, a volume discrepancy was noted in a 10,000-gallon UST; therefore, this tank and an adjacent 10,000-gallon tank, originally installed in 1972, were taken out of service shortly afterwards. In 1987, the two 10,000-gallon USTs were removed and replaced with a single 15,000-gallon UST. During removal, a small hole was noticed in one of the tanks. It is estimated that approximately 6,000 gallons of unleaded fuel may have leaked into the surrounding soil. In 1992, two additional 10,000-gallon USTs were removed and replaced.

The USGS conducted a preliminary investigation at Site ST-18 in 1990 as part of a groundwater characterization study. Five groundwater monitoring wells were installed. Elevated levels of benzene, toluene, and xylenes were detected in groundwater samples collected downgradient from Site ST-18, indicating a plume of dissolved benzene may be present.

Site ST-18 was added to the K. I. Sawyer AFB IRP in 1992 after petroleum-contaminated soils were discovered during UST removal/replacement operations. Approximately 630 cubic yards of contaminated soil were removed to Site ST-16 to undergo thermal treatment. However, due to the depth of the contamination, not all contaminated soil was removed from the site. This prompted the inclusion of this site into the Central Base TCE and Benzene Groundwater Contamination OU (OU-2) in 1991. OU-2 will undergo an RI/FS, scheduled for spring 1996, to better define the extent and type of contamination and evaluate remediation technologies.

As an IRA, a groundwater pump-and-treat system was installed in the central portion of the base along Fifth Street in 1993 and became operational in June 1994. Site ST-18 is undergoing a supplemental RI/FS, which is scheduled for completion by fall 1995.

BUILDING 709 USTs

Building 709 (Site ST-19) is in the northern industrial area, near the intersection of Avenue G and Seventh Street. The site consists of five USTs installed in 1959, including four diesel fuel tanks (three 30,000-gallon USTs and one 12,000-gallon UST) and one 2,000-gallon waste oil UST. All USTs were removed from this site in September 1991. During removal operations, contaminated soil was discovered and transported to Site ST-16 for thermal treatment. Although the tanks have never been tightness tested, it is believed that the release of fuel occurred during overfills of the diesel tanks.

Site ST-19 was added to the K. I. Sawyer AFB IRP in 1992 after petroleum-contaminated soils were discovered during UST removal/replacement

operations. Approximately 1,600 cubic yards of contaminated soil were removed to Site ST-16 to undergo thermal treatment. However, due to the depth of the contamination, not all contaminated soil was removed from the site. Therefore, Site ST-19 was included in the Central Base TCE and Benzene Groundwater Contamination OU (OU-2) in 1991. OU-2 will undergo an RI/FS, scheduled for spring 1996, to better define the extent and type of contamination and evaluate remediation technologies.

As an IRA, a groundwater pump-and-treat system was installed in the central portion of the base along Fifth Street in 1993 and became operational in June 1994. At Site ST-19, a supplemental RI/FS is under way and is scheduled for completion by fall 1995. Additional investigations to identify the source of central base groundwater contamination were initiated in summer 1994.

BUILDING 1247 USTs

Building 1247 (Site ST-20) is a BX Service Station in the southeastern part of the base in the residential housing area near the intersection of Voodoo Avenue and Explorer Street. Two 6,000-gallon unleaded gasoline USTs were removed in October 1991. These tanks had been successfully tightness tested in June 1990. An additional 500-gallon uncoated steel UST was discovered and removed in 1991. It is suspected that this tank contained diesel heating fuel for the former filling station building, which was demolished prior to 1980. There are no records of spills or overfills at this site, so the amount of fuel that has been released to the surrounding soil is unknown. The tanks at this site may have contained leaded gasoline; however, this has not been confirmed.

Site ST-20 was added to the IRP in 1992 after soil contamination was discovered during UST removal operations. Soil sampled from the excavation was found to have high concentrations of benzene, toluene, ethylbenzene, and xylene. Approximately 1,050 cubic yards of contaminated soil were removed and transported to Site ST-16 for thermal treatment.

In order to fully characterize the extent of contamination and potential threat to human health at Site ST-20, an RI/FS was completed. The RI was delivered in September 1994 and the FS was delivered in April 1995. A draft Decision Document has been prepared and is being reviewed.

BUILDING 436 USTs

Building 436 (Site ST-21) is a Former Engine Test Facility in the southern portion of the base between the Former Fighter Alert hangar (Building 400) and an Aircraft Support and Storage facility (Building 402). Several underground concrete vaults are located on site, although the exact

dimensions and contents of these vaults is not known. There is almost no information available concerning these vaults since the units that operated the test facility are no longer stationed at K. I. Sawyer AFB. During a visual inspection of the vaults, large quantities of oily liquid were observed, and this liquid may have migrated from the vaults into the surrounding soil.

Site ST-21 was added to the IRP in 1992, due to the presence of the oily liquid discovered during the site inspection. In order to determine the presence and extent of contamination and its potential threat to human health at Site ST-21, an RI/FS is under way. Final remedial actions will be dependent upon the results of the RI/FS, scheduled for completion in March 1995. A planned remedial action, which will include removal of USTs, piping, and any soil contamination, is planned to be completed in 1995.

BUILDING 824 USTs

Building 824 (Site ST-22) is the Base Auto Hobby Shop, located in the central part of the base on Avenue A. A 1,000-gallon waste oil UST, originally installed in 1980, was removed in June 1992.

Site ST-22 was added to the IRP in 1992 after VOC-contaminated soil was discovered during UST removal operations. Approximately 50 cubic yards of petroleum-contaminated soil were collected from the bottom of the excavation and transported to Site ST-16 for thermal treatment. Lead and chromium were also detected in the contaminated soil.

Following the removal of the UST and contaminated soils, Site ST-22 was recommended for no further action by the base and an NFADD was submitted and approved by the regulator and site close-out occurred in March 1995.

BUILDING 610 USTs

Building 610 (Site ST-23) is the Aerospace Ground Equipment Parking Facility, in the central part of the base east of Avenue F between Third and Fourth streets. Three USTs, a 2,000-gallon diesel UST, a 2,000-gallon motor gasoline (MOGAS) UST, and a 3,000-gallon JP-4 UST, originally installed in 1957, were removed from this site in 1992. These USTs were replaced by a 6,000-gallon JP-4 UST, a 10,000-gallon MOGAS UST, and two 15,000-gallon diesel USTs at Building 612.

Site ST-23 was added to the IRP in 1992, after soil contaminated with elevated concentrations of toluene, ethylbenzene, xylene, and polynuclear aromatic hydrocarbons were detected during UST removal operations. Contaminated soil was removed and transported to Site ST-16 for thermal treatment.

In order to fully characterize the extent of contamination and potential threat to human health at Site ST-23, an RI/FS is under way and scheduled for completion in fall 1995.

BUILDING 534 USTs

Building 534 (Site ST-24) is the Military Vehicle Gas Station, located in the central portion of the base near the intersection of Avenue D and Third Street. In 1992, two 4,000-gallon diesel USTs and a 5,000-gallon MOGAS UST were removed as part of the basewide UST removal/replacement project. The three tanks were originally installed in 1957.

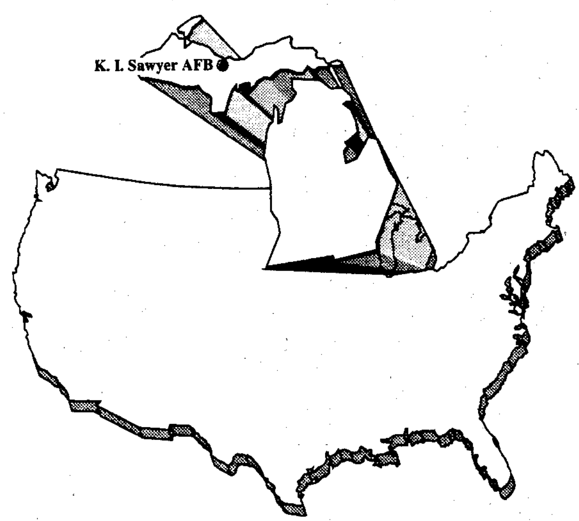
Site ST-24 was added to the IRP in 1992 after soil contamination was discovered during UST removal operations. Soil sampled from the excavation contained high concentrations of toluene, ethylbenzene, and xylene. Contaminated soil was removed and transported to Site ST-16 for thermal treatment.

In order to fully characterize the extent of contamination and potential threat to human health at Site ST-24, an RI/FS is under way and scheduled for completion in fall 1995.

MATERIAL DRYING BEDS

The Material Drying Beds (Site DP-25) are located in the central portion of the base, adjacent to the wastewater treatment plant. The beds were utilized for dewatering and disposal of sewage sludge generated at the wastewater treatment plant from 1960 to 1978. Between 1989 and 1993, the beds were utilized for dewatering and disposal of materials removed from base sand/grease traps and the wastewater treatment plant grit chambers. The site covers approximately 1 acre and may be contaminated with heavy metals, petroleum hydrocarbons, and solvents. The drying beds are not currently in use.

The Material Drying Beds were identified as an Area of Concern during the U.S. EPA's Preliminary Review/Visual Site Inspection survey conducted in 1992 and added to the IRP in 1994. No formal investigations have been conducted at this site. However, base personnel conducted sampling of sludge collected by sand/grease traps, which detected the presence of heavy metals. As a result, an RI/FS is being conducted to assess the threat to human health and the environment, identify remediation goals, and evaluate remediation alternatives.



APPENDIX E

APPENDIX E

METHODS OF ANALYSIS

APPENDIX E

METHODS OF ANALYSIS

1.0 INTRODUCTION

This appendix describes the methods used in preparing this Environmental Impact Statement (EIS). These methods were designed and implemented to evaluate the potential environmental impacts of disposal and reuse of K. I. Sawyer Air Force Base (AFB). Since future reuse of the site is uncertain in its scope, activities, and timing, the analysis considered alternative reuse scenarios and evaluated their associated environmental impacts. The reuse scenarios analyzed in this EIS were defined for this study to span the anticipated range of reuse activities that are reasonably likely to occur due to disposal of the base. They were developed based on proposals put forth by affected local communities, interested individuals, and the Air Force, and considered general land use planning objectives.

The various analysis methods used to develop this EIS are summarized here by resource. In some instances, more detail is included in another appendix. These instances are noted for each resource in its respective subsection below.

2.0 LOCAL COMMUNITY

2.1 COMMUNITY SETTING

The section on community setting was developed to provide the context within which other biophysical impacts could be assessed. Community setting impacts were based on projected direct and secondary employment and resulting population changes related to reuse of K. I. Sawyer AFB. These projections were used to quantify and evaluate changes in demand on community services, transportation systems, air quality, and noise. A complete assessment of socioeconomic effects was conducted through a separate Socioeconomic Impact Analysis Study (SIAS) for the Disposal of K. I. Sawyer AFB, which is the source for baseline and projected statistics used in this EIS.

The SIAS used information from sources including the U.S. Bureau of Economic Analysis; U.S. Bureau of Labor Statistics; U.S. Council of Economic Advisors; U.S. Bureau of the Census; Michigan Department of Economic Development; Northern Michigan University; the counties of Marquette and Delta; the cities of Marquette, Ishpeming, and Negaunee; and the townships of Forsyth, Sands, and West Branch. The analysis used the Regional Interindustry Multiplier System (RIMS II) model to generate

demographic projections associated with the Proposed Action and alternatives.

2.2 LAND USE AND AESTHETICS

Potential land use impacts were projected based on compatibility of land uses associated with the Proposed Action and alternatives with adjacent land uses and zoning; consistency with general plans and other land use plans and regulations; and effects of aircraft noise and safety restrictions on land uses.

The Region of Influence (ROI) for the majority of direct land use impacts for this study consisted of K. I. Sawyer AFB, Marquette County, and the townships of Forsyth, Sands, and West Branch. Noise-related land use impacts were determined by the extent of noise contours created by reuse alternatives and included Marquette County and the townships that surround the base.

U.S. Air Force tab maps, aerial photographs, and windshield surveys were used to characterize on- and off-base land uses. Applicable policies, regulations, and land use restrictions were identified from the land use plans and ordinances of Marquette County, and the townships of Forsyth, Sands, and West Branch. The Proposed Action and alternative reuse plans were compared with existing land use and zoning to identify areas of conflict, as well as to local planning goals and objectives as set forth in General Plans. The other land use concepts were also examined for compatibility with adjacent land uses and with the Proposed Action and alternatives using the same process.

Alternatives incorporating airfield uses were examined for consistency with the K. I. Sawyer AFB Air Installation Compatible Use Zone (AICUZ) study, Federal Aviation Administration (FAA) regulations, and recommended land uses in the vicinity of airfields. Impacts of airfield-generated noise were assessed by comparing the extent of noise-affected areas and receptors under different reuse alternatives with preclosure baseline conditions.

For the aesthetics analysis, the affected environment was described based upon the visual sensitivity of areas within and visible from the base. These areas were identified based on a windshield survey in fall 1993 and a review of aerial photographs. These areas were categorized as high, medium, and low sensitivity. The Proposed Action and alternatives were then evaluated to identify land uses to be developed, visual modifications that would occur, and new areas of visual sensitivity, and to determine whether modification of unique or otherwise irreplaceable visual resources would occur and detract from the visual qualities or setting. Consistency with applicable plans that protect visual resources was also examined.

2.3 TRANSPORTATION

Potential impacts to transportation due to the Proposed Action and alternative reuse plans for K. I. Sawyer AFB focus on key roads, local airport use, and rail service in the area, including those segments of the transportation networks in the region that serve as direct linkages to the base. The need for improvements to on-base roads, off-base access, and regional arterials was considered. The analysis was derived using information from state and local government agencies, including the Michigan Department of Transportation, Marquette County Highway Department, local law enforcement agencies, local airport authorities, and railroad companies. Other data sources used for the roadway analysis include the Institute of Transportation Engineers and the Transportation Research Board. The ROI for the transportation analysis includes the existing principal road, air, and rail networks that serve the local communities of Marquette, Gwinn, Skandia, and Little Lake, with emphasis on the area immediately surrounding K. I. Sawyer AFB.

The number of vehicle trips expected as a result of specific land uses on the site was estimated for 1995, 2000, 2005, and 2015 on the basis of direct on-site jobs and other attributes of on-site land uses (such as the number of dwelling units, and institutional, commercial, industrial, and general aviation activities). Trip Generation Data from the Institute of Transportation Engineers was used to determine vehicle trips. Vehicle trips were then allocated to the local road network using prior patterns and expected destinations and sources of trips. When appropriate, the local road network was adjusted to account for changes over time from currently planned road capacity improvements and improvements required by the proposed reuse scenarios. Changes in work and associated travel patterns were derived by assigning or removing traffic to or from the most direct commuting routes. Changes in traffic volumes arising from reuse alternatives at K. I. Sawyer AFB were estimated and resulting volume changes on key regional, local, and on-base roadway segments were then determined.

The transportation network in the ROI was then examined to identify potential impacts to Levels of Service (LOS) arising from future baseline conditions and the direct and indirect effects of reuse alternatives. The planning application from the Highway Capacity Manual provided estimates of LOS resulting from changes in traffic. The planning procedures used in this analysis were based on forecasts of peak hour volumes and on assumed traffic, roadway, and control conditions. Intersections were considered where appropriate. The results provided an estimate of the changes in LOS ratings expected as a result of traffic volume changes on key regional, local, and on-base roadway segments.

Airspace use in the vicinity of an airport is driven primarily by such factors as runway alignment, surrounding obstacles and terrain, air traffic control

and navigational aid capabilities, proximity of other airports/airspace uses in the area, and noise considerations. These same factors normally apply regardless of whether the airport is used for military or civil aircraft operations. For this reason, a preclosure reference was used in characterizing these factors related to airspace use at K. I. Sawyer AFB.

Historical data on military aircraft operations used to characterize airspace use at and around K. I. Sawyer AFB were obtained from the base. Airport owners/operators were contacted to obtain information on civil airport use, both historical and projected. Military and civil aviation forecasts were derived from conversations with these two groups concerning their expectations of future demand under various scenarios and, where necessary, assumptions were made based on other similar airport operational environments.

The ROI for the airspace analysis is an area within a 20-nautical-mile radius of K. I. Sawyer AFB from the surface up to 12,000 feet above mean sea level (see Figure 3.2-13). This ROI encompasses the airspace delegated to the K. I. Sawyer AFB Radar Approach Control for providing Instrument Flight Rules and Visual Flight Rules flight-following services to aircraft. Additionally, the K. I. Sawyer AFB Air Traffic Control Tower is responsible for providing air traffic control to other airfields in the region to minimize potential airspace conflicts.

The types and levels of aircraft operations projected for the Proposed Action and alternatives were evaluated and compared to the way airspace was configured and used under the preclosure reference. The capacity of the airport to accommodate the projected aircraft fleet and operations was assessed by calculating the airport service volume, using the criteria in the FAA Advisory Circular 150/5060-5. Potential effects on airspace use were assessed, based on the extent to which projected operations could (1) require modifications to the airspace structure or air traffic control systems and/or facilities; (2) restrict, limit, or otherwise delay other air traffic in the region; or (3) encroach on other airspace areas and uses. It was recognized throughout the analysis process that a more in-depth study would be conducted by the FAA, once a reuse plan is selected, to identify any impacts of the reuse activities and what actions would be required to support the projected aircraft operations. Therefore, this analysis was used only to consider the level of operations that could likely be accommodated under the existing airspace structure, and to identify potential impacts if operational capacities were exceeded.

Projections of civil aviation activity for the aviation reuses were derived by (1) defining a Competitive Market Area based on geographical factors and alternative facilities; (2) developing future levels of civilian based aircraft in the defined Competitive Market Area; (3) estimating relocation of these civilian aircraft to K. I. Sawyer AFB after the departure of the active duty

forces based on conversations with airport owners/representatives, as well as assumptions based on similar airport operational environments; and (4) projecting future operational and air traveler visitor levels of activity based on reasonable "rule of thumb" ratios. A similar approach described in steps 3 and 4 above was used to derive activity levels for the air cargo, passenger, and aircraft maintenance scenarios at K. I. Sawyer AFB.

Information regarding existing rail transportation was obtained from the Michigan Department of Transportation.

2.4 UTILITIES

Utility usage was determined based on land uses and projected area population increases. The utility systems addressed in this analysis include the facilities and infrastructure used for potable water (pumping, treatment, storage, and distribution), wastewater (collection and treatment), solid waste (collection and disposal), and energy generation and distribution (electricity and natural gas). Historic consumption data, service curtailment data, peak demand characteristics, storage and distribution capacities, and related information for base utilities (including projections of future utility demand for each utility provider's particular service area) were extracted from various engineering reports and K. I. Sawyer AFB personnel. Information was also obtained from public and private utility purveyors and related county and city agencies.

The ROI for this analysis comprised the service areas of the local purveyors of potable water, wastewater treatment, and energy that serve the surrounding area. The analysis also reviews the existing utilities systems on K. I. Sawyer AFB. It was assumed that these local purveyors would provide services within the area of the existing base after disposal/reuse.

Potential impacts were evaluated based on long-term projections of demand and population obtained from the various utility purveyors within the region (through 2015) for each of their respective service areas. In each case, purveyors provided the most recent comprehensive projections that were either made prior to the base closure announcement or that did not take into account a change in demand from the base. These projections were then adjusted to reflect the decrease in demand associated with closure of K. I. Sawyer AFB and its subsequent operation under caretaker status. These adjusted forecasts were then considered the future baseline for comparison with potential reuse alternatives.

The potential effects of reuse alternatives were evaluated by estimating and comparing the additional direct and indirect demand associated with each alternative to the existing and projected operating capabilities of each utility system. Estimates of direct utility demands on site were used to identify the effects of the reuse activities on site-related utility systems. All changes

to the utility purveyors' long-term forecasts were based on estimated reuse-related population changes in the region, and on the future rates of per capita demand explicitly indicated by each purveyor's projections or derived from those projections. It was assumed that the regional per capita demand rates were representative of the reuse activities, based on assumed similarities between proposed land uses and existing or projected uses in the region. Projections in the utilities analysis include direct demand associated with activities planned on base property, as well as resulting changes in domestic demand associated with population changes in the region.

3.0 HAZARDOUS MATERIALS AND HAZARDOUS WASTE MANAGEMENT

Two categories of hazardous materials and hazardous waste management issues were addressed for this analysis: (1) impacts of hazardous materials utilized and hazardous wastes generated by each reuse proposal and (2) residual impacts associated with past Air Force practices including delays due to Installation Restoration Program (IRP) site remediation. IRP sites were identified as part of the affected environment (Chapter 3), while remediation impacts associated with these sites were addressed as environmental consequences (Chapter 4). Impacts of wastes generated by each reuse proposal were also addressed in Chapter 4. Primary sources of data were existing published reports such as IRP documents, management plans for various toxic or hazardous substances (e.g., spill response, hazardous waste, asbestos), and survey results (e.g., radon). Pertinent federal, state, and local regulations and standards were reviewed for applicability to the Proposed Action and alternatives. Hazardous materials and waste inventories and a hazardous waste management plan were obtained from K. I. Sawyer AFB. Interviews with personnel associated with these on-base agencies provided the information necessary to fill any data gaps. State and local agencies were also contacted regarding regulations that would apply to both current and post-closure activities for K. I. Sawyer AFB.

The ROI includes the current base property and all geographical areas that have been affected by an on-base release of a hazardous material or hazardous waste. The IRP sites are located within the base boundary with the exception of a trichloroethylene groundwater plume that has migrated beneath the privately owned parcel in the center of the base.

Preclosure baseline conditions as defined for this study include current hazardous materials/waste management practices and inventories pertaining to the following areas: hazardous materials, hazardous waste, IRP sites, aboveground and underground storage tanks, asbestos, pesticides, polychlorinated biphenyls (PCBs), radon, medical/biohazardous waste, ordnance, and lead-based paint. The impact analysis considered (1) the amount and type of hazardous materials/waste currently associated with specific facilities and/or areas proposed under each reuse alternative; (2) the

regulatory requirements or restrictions associated with property transfer and reuse; (3) delays to development due to IRP remediation activities; and (4) remediation schedules of specific hazardous materials/waste (e.g., PCBs, medical/biohazardous waste) currently used or generated by the Air Force.

4.0 NATURAL ENVIRONMENT

4.1 GEOLOGY AND SOILS

Evaluation of soils impacts addressed erosion potential, construction-related dust generation and other soils problems (low soil strength, expansive soils, etc.), and disturbance of unique soil types. Information was obtained from several federal, state, and local agencies. Assessment of potential impacts to geology from the reuse alternatives included evaluation of resource potential (especially aggregates), geologic hazards (particularly potential for seismicity, liquefaction, and subsidence), and flooding potential.

The ROI for the geologic analysis included the region surrounding K. I. Sawyer AFB relative to seismic activity, mineral resources, and flooding potential. The ROI for the soils analysis was limited to the base and specific areas designated for construction or renovation.

The soils analysis was based on a review of Natural Resources Conservation Service documents for soil properties. The soils in the ROI were then evaluated for erosion potential, permeability, evidence of hardpans, expansive soil characteristics, etc., as these relate to construction problems and erosion potential during construction. Mitigations were evaluated based on county ordinances and Natural Resources Conservation Service recommendations. Common engineering practices were reviewed to determine poor soil characteristics and recommended mitigation measures.

The geologic analysis was based on a review of existing literature for construction problems associated with geologic hazards, availability of construction aggregate, and whether reuse would impact the availability of known mineral resources.

4.2 WATER RESOURCES

Analysis of impacts of the reuse alternatives on water resources considered groundwater quality and quantity, surface water quality (effects from erosion or sedimentation and contamination), surface water drainage diversion, and non-point source surface runoff and water availability. Impacts to water quality resources resulting from IRP activities were addressed under Hazardous Materials and Hazardous Waste Management. Information was obtained from several federal, state, and local agencies. The ROI for water resources included the groundwater basin underlying the

base, the surface drainage directly affected by runoff from the base, and the 100-year floodplain in the vicinity of the base.

Existing surface water conditions were evaluated for flood potential, non-point source discharge or transportation of contaminants, and surface water quality. Groundwater quality and the potential as a potable water source for each reuse alternative was documented. The existing storm water drainage system was evaluated based on available literature, and the impacts to this system from each of the reuse alternatives were determined.

4.3 AIR QUALITY

The air quality resource is defined as the condition of the atmosphere, expressed in terms of the concentrations of air pollutants occurring in an area as the result of emissions from natural and/or man-made sources. Reuse alternatives have the potential to affect air quality depending on net changes in the release of both gaseous and particulate matter emissions. The impact significance of these emission changes was determined by comparing the resulting atmospheric concentrations to state and federal ambient air quality standards. This analysis drew from climatological data, air quality monitoring data, baseline emission inventory information, construction scheduling information, reuse-related source information, and transportation data. Principal sources of these data were the U.S. Environmental Protection Agency, Michigan Department of Natural Resources-Air Quality Division, K. I. Sawyer AFB Bioenvironmental Engineer, and Weather Squadron.

The ROI was determined by emissions from sources associated with construction and operation of the reuse alternatives. For inert pollutant emissions (all pollutants other than ozone and its precursors), the measurable ROI is limited to a few miles downwind from the source, (i.e., the immediate area of K. I. Sawyer AFB). The ROI for ozone impacts from project emissions included the upper Michigan Air Quality Control Region.

Emissions predicted to result from the proposed alternatives were compared to existing baseline emissions to determine the potential for adverse air quality impact. Impacts were also assessed by modeling, where appropriate, and compared to air quality standards. Appendix I contains the projected emissions inventory information and methods. Estimated background concentrations were added to the reuse-related impacts for comparison with the standards. Impacts were considered significant if reuse-related emissions would (1) increase an off-site ambient pollutant concentration from below to above a federal or state standard or (2) expose sensitive receptors (such as schools or hospitals) to substantial pollutant concentrations. All other air quality impacts were considered insignificant.

4.4 NOISE

The noise analysis addressed potential noise impacts from reuse-generated aircraft operations, surface traffic, and other identified noise sources on communities surrounding K. I. Sawyer AFB. Most of the data were obtained from the aircraft operations and traffic data prepared for the reuse alternatives. Day-night levels (DNL) were used to determine noise impacts. A single-event noise analysis using sound exposure levels (SELs) was also performed. In addition, scientific literature on noise effects was referenced.

The ROI for noise was defined as the area within DNL 65 decibel (dB) contours based on land use compatibility guidelines developed from FAA regulations. The ROI for surface traffic noise impacts incorporated key road segments identified in the transportation analysis.

Noise levels from aircraft operations were estimated using the FAA-approved Integrated Noise Model (INM), Version 4.11. Noise contours for DNL 65 dB and above were depicted. Noise levels due to surface traffic were estimated using the Federal Highway Administration's Highway Noise Model. Potential noise impacts were identified by overlaying the noise contours with land use and population information to determine the number of residents who would be exposed to DNL above 65 dB.

SELs related to reuse alternatives were provided for representative noise sensitive receptors exposed to aircraft noise from the K. I. Sawyer AFB airfield. The SELs presented were outdoor levels and took into account the location of the receptors relative to the various flight tracks and aircraft profiles used. Noise reduction effects for common construction were included in the sleep interference analysis; however, evaluation of sensitive receptors relative to noise reduction levels of specific structures was not performed.

Methods used to analyze noise impacts under each reuse scenario are presented in detail in Appendix J of this EIS.

4.5 BIOLOGICAL RESOURCES

For analysis of impacts, biological resources were divided into vegetation, wildlife, threatened and endangered species, and sensitive habitats. Data sources included general plans; aerial photographs, environmental evaluations, and inventories or descriptions of the base; U.S. Fish and Wildlife Service National Wetlands Inventory maps; rare, candidate, threatened, and endangered species lists; general information from federal and state agencies; and the following reference books: Gray's Manual of Botany, Michigan Trees, Shrubs of Michigan, Michigan Wildflowers, Michigan Mammals, the Atlas of Breeding, Birds of Michigan, Mammals of the Eastern United States, Birds of North America, and Atlas of North

American Freshwater Fishes. Site visits were conducted to gather information on habitat quality and to map vegetation, wetlands, and other sensitive habitats.

The ROI for biological resources included the base property and off-base drainages that receive runoff from base surface water.

Analysis of impacts to vegetation included the effects of management practices, construction disturbance, herbicide use, or possible toxic contamination. Wildlife impacts addressed included habitat destruction, increased stress from noise or human presence, and individual mortality from airplane strikes. Impacts to candidate, threatened, and endangered species were especially noted where applicable. Sensitive habitats were defined as areas protected by regulations (such as wetlands and habitat for protected species), and plant communities having agency concern for being unusual, being limited in distribution, or being important seasonal use areas for wildlife. Impacts to sensitive habitats that may occur from habitat loss or degradation, noise impacts, increase in human use of an area, and other sources were addressed.

Some potential indirect impacts to biological resources considered in this analysis included erosion (habitat loss, water pollution) and recreational use of natural areas. Standard biological regulations, such as the Endangered Species Act and Clean Water Act, were considered in this analysis.

4.6 CULTURAL RESOURCES

Cultural resources generally include three main categories: prehistoric resources, historic structures and resources, and traditional resources. For the purposes of this EIS, cultural resources were defined to also include paleontological resources (the fossil evidence of past plant and animal life). Prehistoric resources are places where human activity has measurably altered the earth or left deposits of physical remains. Historic structures and resources include standing structures and other physical remains of historic significance. Traditional resources are topographical areas, features, habitats, plants, animals, minerals, or archaeological sites that contemporary Native Americans or other groups value presently, or did so in the past, and consider essential for the persistence of their traditional culture. Cultural resources of particular concern include properties listed on the National Register of Historic Places (NRHP), properties potentially eligible for the NRHP, and sacred Native American sites and areas.

Data used to compile information on these resources were obtained from material on file at K. I. Sawyer AFB; a basewide archaeological survey; interviews with individuals familiar with the history, archaeology, or paleontology of the Upper Peninsula of Michigan; and records of the Information Center of the Michigan Archaeological Inventory. The ROI for

cultural resources included all areas within the boundaries of K. I. Sawyer AFB.

The EIS contains the most up-to-date information on the importance of cultural resources on K. I. Sawyer AFB, based on recent and ongoing evaluation of eligibility for the NRHP. Cultural resources for which eligibility information was unavailable were assumed to be eligible for the NRHP, as is stipulated in the National Historic Preservation Act (NHPA).

According to NRHP criteria (36 Code of Federal Regulations [CFR] 60.4), the quality of significance is present in districts, sites, buildings, structures, and objects that:

- Are associated with events that have made a significant contribution to the broad patterns of history

- Are associated with the lives of persons significant in the past

- Embody the distinctive characteristics of a type, period, or method of construction; represent the work of a master; possess high artistic value; or represent a significant and distinguishable entity whose components may lack individual distinction

- Have yielded, or may be likely to yield, information important in prehistory or history.

To be listed in or considered eligible for listing in the NRHP, a cultural resource must meet at least one of the above criteria and must also possess integrity of location, design, setting, materials, workmanship, feeling, and association. Integrity is defined as the authenticity of a property's historic identity, as evidenced by the survival of physical characteristics that existed during the property's historic or prehistoric occupation or use. If a resource retains the physical characteristics it possessed in the past, it has the capacity to convey information about a culture or people, historical patterns, or architectural or engineering design and technology.

Compliance with requirements of cultural resource laws and regulations ideally involves four basic steps: (1) identification of significant cultural resources that could be affected by the Proposed Action or alternatives, (2) assessment of the impacts or effects of these actions, (3) determination of significance of potential historic properties within the ROI, and (4) development and implementation of measures to eliminate or reduce adverse impacts. The primary law governing cultural resources in terms of their treatment in an environmental analysis is the NHPA, which addresses the protection of archaeological, historic, and Native American resources. In compliance with Sections 106 and 111 of the NHPA, the Air Force is consulting with the State Historic Preservation Officer.

Adverse effects that may occur as a result of base reuse are those that have a negative impact on characteristics that make a resource eligible for listing on the NRHP. Actions that can diminish the integrity, research potential, or other important characteristics of a historic property include the following (36 CFR 800.9):

- Physical destruction, damage, or alteration of all or part of the property
- Isolating the property from its setting or altering the character of the property's setting when that character contributes to the property's qualification for the NRHP
- Introduction of visual or auditory elements that are out of character with the property or that alter its setting
- Transfer or sale of a federally owned property without adequate conditions or restrictions regarding its preservation, maintenance, or use
- Neglect of a property, resulting in its deterioration or destruction.

Regulations for implementing Section 106 of the NHPA indicate that the transfer, conveyance, lease, or sale of an historic property are procedurally considered to be adverse effects, thereby ensuring full regulatory consideration in federal project planning and execution. However, effects of a project that would otherwise be found to be adverse may not be considered adverse if one of the following conditions exists:

- When the historic property is of value only for its potential contribution to archaeological, historical, or architectural research, and when such value can be substantially preserved through the conduct of appropriate research, and such research is conducted in accordance with applicable professional standards and guidelines
- When the undertaking is limited to the rehabilitation of buildings and structures and is conducted in a manner that preserves the historical and architectural value of the affected historic property through conformance with the Secretary's Standards for Rehabilitation and Guidelines for Rehabilitation of Historic Buildings
- When the undertaking is limited to the transfer, conveyance, lease, or sale of an historic property, and adequate restrictions or conditions are included to ensure preservation of the property's significant historic features.

The treatment of paleontological resources is governed by Public Law 74-292 (the National Natural Landmarks Program, implemented by 36 CFR 62). Only paleontological remains determined to be significant are subject to consideration and protection by a federal agency. Among the criteria used for National Natural Landmark designation are illustrative character, present condition, diversity, rarity, and value for science and education.

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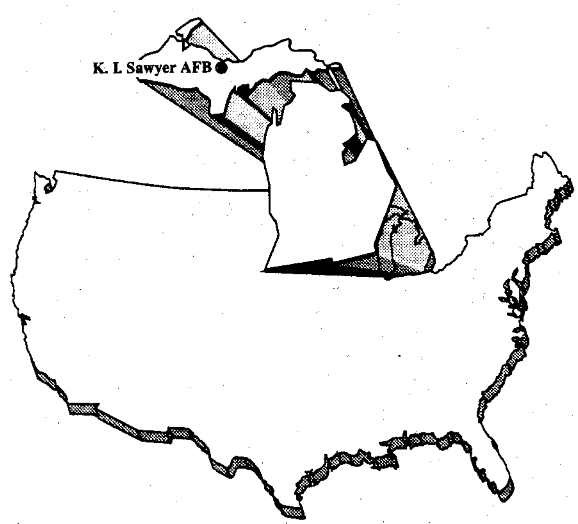

APPENDIX F

APPENDIX F

ENVIRONMENTAL PERMITS HELD BY K. I. SAWYER AIR FORCE BASE

APPENDIX F

ENVIRONMENTAL PERMITS HELD BY K. I. SAWYER AFB

Permit No.	Permitted Facility/Equipment	Issuing Agency	Original Date Issued	Date of Expiration
Air Emissions				
24-781	Hospital Incinerator	MDNR	9/11/78	Indefinite
914-87	Heat Plant	MDNR	2/1/88	Indefinite
846-87	Heat Plant	MDNR	2/1/88	Indefinite
337-84	Heat Plant	MDNR	5/30/84	Indefinite
389-85	JP-10 Tanks	MDNR	5/14/86	Indefinite
125-72	Explosive Ordnance Disposal Range	MDPH	5/16/72	Indefinite
475-92	Plastic Media Blast Cabinet	MDNR	5/1/93	Indefinite
474-92	Plastic Media Blast Cabinet	MDNR	7/16/92	Indefinite
111-93	Soil Remediation	MDNR	10/15/93	Indefinite
74-92	Groundwater Treatment Facility	MDNR	9/24/93	Indefinite
RCRA				
Part B[a]	Defense Reutilization and Marketing Office	MDNR	Application submitted 9/88	To Be Determined
Part X[a]	Explosive Ordnance Disposal Range	MDNR	Application submitted 5/90	To Be Determined
Sewer Discharge				
MI0021423	NPDES-Base Wastewater Treatment Plant	MDNR	3/13/84	2/28/88
Pending[b]	Basewide storm water	MDNR	Pending Approval	To Be Determined
MI0052990	NPDES-Groundwater Treatment Facility	MDNR	4/22/93	10/1/97
93-03-0041	Groundwater Treatment Facility (Inland Lakes and Streams Permit)	MDNR	9/15/93	12/31/94

Notes: (a) Acting under interim status, pending permit approval.
(b) Air Combat Command Group Application in process.
MDNR = Michigan Department of Natural Resources
MDPH = Michigan Department of Public Health
NPDES = National Pollutant Discharge Elimination System
RCRA = Resource Conservation and Recovery Act

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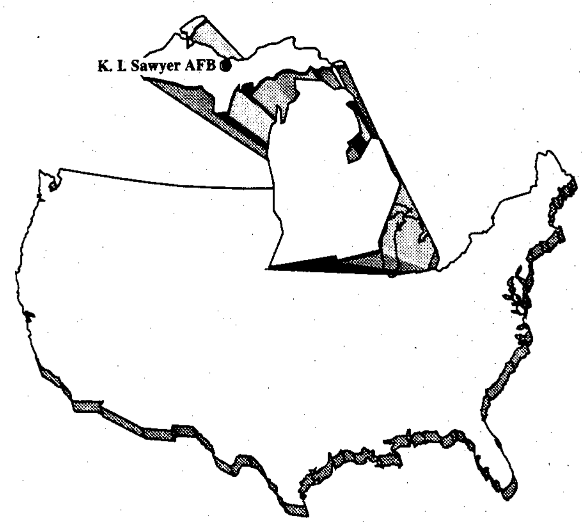

APPENDIX G

APPENDIX G

STORAGE TANKS, OIL/WATER SEPARATORS, PESTICIDE STORAGE, AND SOLID WASTE MANAGEMENT UNITS AND AREAS OF CONCERN AT K. I. SAWYER AIR FORCE BASE

Table G-1. Waste Oil Collection Points

Building	Description	Capacity (gallons)	Method of Storage
333	Ammunition Storage	550	UST
411	Hydrant Fueling System Pumphouse	550	UST
417	Defense Reutilization and Marketing Office	Variable	55-gallon drums
421	Storage Facility	Unknown	Unknown
431	Survival Equipment Shop	500	Bowser
438	Refueling Maintenance	6,000	UST associated with oil/water separator
521	Heating Facility	2,000	UST
530	Vehicle Maintenance	500	Concrete tank associated with oil/water separator
608	Vehicle Maintenance	785	Concrete tank associated with oil/water separator
609	Refueling Vehicle Maintenance	5,000	UST
627	Organizational Maintenance	500	Bowser
668	Fuel Cell Maintenance	Unknown	Concrete tank associated with oil/water separator
709	Electrical Power Generator Building	1,000	UST
720	Hydrant Fuel Pump House	1,000	UST
721	Hydrant Fuel Pump House	1,000	UST
723	Hydrant Fuel Pump House	1,000	UST
724	Hydrant Fuel Pump House	1,000	UST
740	Jet Engine Maintenance	500	Bowser
742	Jet Engine Test Cell	1,000	UST associated with oil/water separator
824	Auto Hobby Shop	1,000	UST
826	BX Service Station	550	UST
869	Sewage Treatment Plant	1,000	UST associated with oil/water separator
4005	Aircraft Maintenance	2,000	UST associated with oil/water separator
4009	Integrated Maintenance	2,000	UST associated with oil/water separator
4010	Aircraft Support Equipment Shop	1,900	Concrete tank associated with oil/water separator
4033	Refueling Vehicle Maintenance	1,000	UST associated with oil/water separator
4035	Weapons Training Maintenance	550	Concrete tank associated with oil/water separator
7083	Fire Training Facility	Unknown	Unknown

BX = Base Exchange
UST = underground storage tank

Table G-2. Solid Waste Management Units and Areas of Concern
Page 1 of 4

SWMU	Names/Description
1[a]	Hazardous Waste Storage Area - Building 744
2[a]	Hazardous Waste Storage Area - Building 417
3[a]	Defense Reutilization and Marketing Office Storage Yard - Facility 419
4[a]	POL Area Tank Confinement Berms
5	Open Burning/Open Detonation Range (EOD Range) - Facility 5029
6[a]	Fire Training Area No. 1
7[a]	Fire Training Area No. 2 - Facility 7083
8[a]	Landfill No. 1
9[a]	Landfill No. 2
10[a]	Landfill No. 3
11[a]	Landfill No. 4
12[a]	Hardfill No. 2
13[a]	Drainage Ponds No. 1
14[a]	Drainage Ponds No. 2
15[a]	Drainage Ponds No. 3 - Building 740
16[b]	Hospital Incinerator - Building 850
17[b]	Classified Document Incinerator
18[b]	Coal-Fired Boilers, Cyclones, and Electrostatic Precipitators, Power Plant - Building 521
19[b]	Wood-Chip/Coal Fired Boiler Cyclone & Baghouses, Power Plant - Building 521
20[b]	Boiler Ash Collection System and Silo, Power Plant - Building 521
21[b]	Current Boiler Ash Loading Room, Power Plant - Building 521
22[b]	Former Boiler Ash Loading Room, Power Plant - Building 521
23	Former Ash Settling Pit, Power Plant - Building 520
24[b]	Boiler Blowdown Gravel Disposal Bed, Power Plant - Building 521
25[b]	Cooling Tower Blowdown Discharge Areas, Power Plant - Building 521
26	Sanitary Sewer System - Basewide System
27	Storm Sewer System - Basewide System
28	Influent Wet Well, WWTP
29	Primary Clarifiers, WWTP - Building 869
30	Rotating Biological Contactors, WWTP - Building 863
31	Rotating Biological Contactors Tank, WWTP - Building 863
32	Secondary Clarifiers, WWTP
33	Effluent Wet Well, WWTP
34	Inactive Rapid Sand Filters, WWTP - Building 862
35	Chlorine Contact Chamber, WWTP - Building 864
36	Dechlorination Cylinders, WWTP - Building 864
37	Sludge Holding Tank, WWTP
38	Sludge Gravity Thickener, WWTP
39	Aerobic Digestors (4), WWTP - Building 857
40	Sludge Decant Tank, WWTP

EOD = explosive ordnance disposal
POL = petroleum, oil, and lubricants
WWTP = wastewater treatment plant
SWMU = solid waste management unit

Table G-2. Solid Waste Management Units and Areas of Concern
Page 2 of 4

SWMU	Names/Description
41	Sludge Storage Tanks, WWTP - Building 4006
42	Industrial Wastewater Aerator Lagoon, WWTP
43	Industrial Wastewater Oil/Water Separator and Waste Oil UST, WWTP - Building 869
44	Former Treatment Plant Units (Dosing Chamber, Trickling Filter, Final Settling Tanks), WWTP - Building Removed
45	Former Sludge Digestors and Sludge Drying Beds, WWTP - Building Removed
46	Land Surface Sludge Disposal Sites - various locations
47[b]	"Safety Kleen" Units & Parts Cleaners - various locations
48[b]	Carpenter Shop Waste Sawdust Collection System
49	Former Oil Storage UST - Building 709
50[b]	Current Waste Oil UST - Building 709
51	POL Area Waste POL Storage Pump - Building 405
52[b]	Liquid Fuels Maintenance Temporary Waste Storage Area - Building 438
53[b]	Propulsion Branch Hazardous Waste Accumulation Area - Building 740/741
54[b]	Equipment Maintenance Hazardous Waste and Waste Oil Accumulation Area - Building 431
55[b]	Aerospace Ground Equipment Waste Oil Accumulation Area - Building 610
56[b]	Spent Battery Storage Area - Building 610
57[c]	Inactive Lime Pit - Building 610
58[b]	Corrosion Control Waste Paint Accumulation Area - Building 667
59[b]	Corrosion Control Media Blaster Filter and Hazardous Waste Accumulation Area - Building 667
60[b]	Corrosion Control Solvent Still - Building 667
61[b]	Corrosion Control Still Bottom Hazardous Waste Accumulation Area - Building 667
62[b]	Current Pneudraulics Waste Oil Accumulation Area - Building 725
63[b]	Non-Destructive Test Hazardous Waste Accumulation Area - Building 725
64[b]	Battery Shop Spent Battery Storage Area - Building 725
65	Inactive/Former Lime Pit - Building 725
66[b]	Former Spent Carbon Remover Storage Tank - Building 725
67[b]	Former Pneudraulics Waste Oil Storage Tank - Building 725
68[b]	Hazardous Waste Accumulation Area - Building 824
69[b]	Current Waste Oil Accumulation Area - Building 824
70	Waste Oil UST - Building 824
71[b]	Paint Booth Filters - Building 824
72[b]	Silver Recovery Unit - Building 601
73	Base Exchange Gas Station Waste Oil UST - Building 826
74[b]	Equipment Maintenance Current Hazardous Waste and Waste Oil Accumulation Area - Building 441
75[b][d]	Equipment Maintenance Former Waste POL Accumulation Area - Building 400/441
76[b]	Weapons Release Waste POL Accumulation Area - Building 400

POL = petroleum, oil, and lubricants
SWMU = solid waste management unit
UST = underground storage tank
WWTP = wastewater treatment plant

Table G-2. Solid Waste Management Units and Areas of Concern
Page 3 of 4

SWMU	Names/Description
77[b]	Civil Engineering Squadron Paint Shop Hazardous Waste Accumulation Area - Building 408
78[b]	Hazardous Waste Accumulation Area - Building 608
79[b]	Vehicle Maintenance Waste Oil/Hydraulic Fluid Bowser - Building 608
80[c]	Inactive Lime Pit - Building 608
81	Paint Booth Filters - Building 608
82[b]	Waste POL UST - Building 609
83[b]	Heavy Equipment Maintenance Waste Oil Bowser - Building 530
84[b]	Heavy Equipment Maintenance Waste Oil Accumulation Drums - Building 530
85[b]	Missile Maintenance Hazardous Waste Accumulation Area - Building 331
86[b]	Missile Maintenance Waste JP-10 Storage Can - Building 331
87[b]	Missile Maintenance Paint Booth Filters - Building 331
88[b]	Fuel System Maintenance Hazardous Waste Accumulation Cabinet - Building 668
89	Inactive Oil Detention Tank - Building 668
90[b]	Waste POL Accumulation Area - Building 402
91	Contaminated Soil Storage Area - south of Building 902
92[e]	Maintenance Building Floor Drains and Trenches - Buildings 331, 438, 441, 530, 608, 609, 664, 667, 668, 742
93	POL Area Oil/Water Separator - Building 405
94	Oil/Water Separator and Waste Oil UST - Building 438
95	Equipment Maintenance Oil/Water Separator - Building 441
96	Vehicle Maintenance Oil/Water Separator - Building 608
97	Refueling Maintenance Oil/Water Separator and Waste Oil UST - Building 609
98	Propulsion Branch Oil/Water Separator and Waste Oil UST - Building 742
99	Oil/Water Separator and Waste Oil UST - Building 331
100	Heavy Equipment Maintenance Oil/Water Separator and Waste Oil UST - Building 530
101	Weapons Loading Oil/Water Separator and Waste Oil UST - Building 664
102	Fire Training Area No. 2 Oil/Water Separator and Tile Drain Field

POL = petroleum, oil, and lubricants
SWMU = solid waste management unit
UST = underground storage tank

Table G-2. Solid Waste Management Units and Areas of Concern
Page 4 of 4

AOC	Names/Description
103	Operational Apron Underground Jet Fuel Storage Tanks and Supply Lines
104[f]	15 Other USTs - various locations
105	Coal Storage Piles - Power Plant
106	Rifle Range Backstop - Building 5023
107	Trichloroethylene (TCE) contamination near former Engine Repair Shop - Building 725
F	B-52 Crash Site
G	Aboveground Tank - Building 222
H	Former Grenade Range, Weapon Storage Area
I	40 mm Grenade Range, West Side of Runway
J	Spill Cleanup/Investigation - Building 304
K	Spill Cleanup/Investigation - Building 539
L	Drain Pits and Sumps at Industrial Facilities
M	Drainfields and Bypass Systems associated with the Sanitary Sewer System
N	Morale, Welfare, and Recreation and Private Vehicle Parking Areas - Building 504 and Facility 7067

Notes: (a) SWMU/AOC also under Installation Restoration Program investigation.
(b) SWMU with low release potential.
(c) SWMU remediated in summer 1994.
(d) Each facility POL accumulation area is counted as a separate SWMU.
(e) Each facility floor drain and trench are counted as a separate SWMU.
(f) Tank replacement program conducted under Michigan Department of Natural Resources guidelines.
AOC = Area of Concern
mm = millimeter
POL = petroleum, oil, and lubricants
UST = underground storage tank
SWMU = solid waste management unit

Sources: Department of Defense, 1994.

Table G-3. Inventory of Underground Storage Tanks (as of March 30, 1994)
Page 1 of 2

Building	Capacity (gallons)	Content	Date of Installation	Construction Material
120	4,000	Diesel Fuel	1991	Steel[b]
220	1,000	Propane	Unknown	Unknown
318	4,000	Diesel Fuel	1992	Steel[b]
302	50,000	Water	1957	Unknown
331-1	2,000	Waste JP-10	1987	Steel[b]
331-2	7,000	JP-10	1987	Steel[b]
331-3	7,000	JP-10	1987	Steel[b]
331-4	7,000	JP-10	1987	Steel[b]
331-5	7,000	JP-10	1987	Steel[b]
333	550	Waste Oil	1987	Steel[b]
336	7,000	Diesel Fuel	1987	Steel[b]
405[a]	4,000	Waste JP-4	Unknown	Steel
411	550	JP-4	1992	FRP[b]
413	550	JP-4	1992	FRP[b]
438-1	6,000	Waste Oil	1987	Steel[b]
438-2	10,000	Aqueous Film-Forming Foam	1987	Steel[b]
438-3	10,000	Aqueous Film-Forming Foam	1987	Steel[b]
441	550	Waste Oil	1987	FRP[b]
521-1[a]	2,000	Waste Oil	1962	Unknown
521-2	10,000	Diesel Fuel	1988	Steel[b]
530	1,000	Waste Oil	1994	Bitum Coated Steel
603	1,000	Diesel Fuel	1992	FRP[b]
609-1	1,000	Waste JP-4	1991	FRP[b]
609-2	5,000	Waste JP-4	1991	Steel[b]
612-1	6,000	JP-4	1992	Steel[b]
612-2	10,000	Gasoline	1992	Steel[b]
612-3	15,000	Diesel Fuel	1992	Steel[b]
612-4	15,000	Diesel Fuel	1992	Steel[b]
664[a]	2,000	Waste Oil	1987	Steel
701	550	Hydraulic Fluid	Unknown	Unknown
709-1	1,000	Waste Oil	1991	Steel[b]
709-2	15,000	Diesel Fuel	1991	Steel[b]
709-3	15,000	Diesel Fuel	1991	Steel[b]
720-1	1,000	Waste JP-4	1991	FRP[b]
720-2	50,000	JP-4	1958	Epoxy Coated Steel
720-3	50,000	JP-4	1958	Epoxy Coated Steel
720-4	50,000	JP-4	1958	Epoxy Coated Steel

FRP = fiberglass-reinforced plastic

Table G-3. Inventory of Underground Storage Tanks (as of March 30, 1994)
Page 2 of 2

Building	Capacity (gallons)	Content	Date of Installation	Construction Material
720-5	50,000	JP-4	1958	Epoxy Coated Steel
721-1	1,000	Waste JP-4	1991	FRP[b]
721-2	50,000	JP-4	1958	Epoxy Coated Steel
721-3	50,000	JP-4	1958	Epoxy Coated Steel
721-4	50,000	JP-4	1958	Epoxy Coated Steel
721-5	50,000	JP-4	1958	Epoxy Coated Steel
723-1	1,000	Waste JP-4	1991	FRP[b]
723-2	50,000	JP-4	1958	Epoxy Coated Steel
723-3	50,000	JP-4	1958	Epoxy Coated Steel
723-4	50,000	JP-4	1958	Epoxy Coated Steel
723-5	50,000	JP-4	1958	Epoxy Coated Steel
723-6	50,000	JP-4	1958	Epoxy Coated Steel
723-7	50,000	JP-4	1958	Epoxy Coated Steel
724-1	1,000	Waste JP-4	1991	FRP[b]
724-2	50,000	JP-4	1958	Epoxy Coated Steel
724-3	50,000	JP-4	1958	Epoxy Coated Steel
724-4	50,000	JP-4	1958	Epoxy Coated Steel
724-5	50,000	JP-4	1958	Epoxy Coated Steel
724-6	50,000	JP-4	1958	Epoxy Coated Steel
724-7	50,000	JP-4	1958	Epoxy Coated Steel
726	550	Diesel Fuel	1992	FRP[b]
742	1,000	JP-4	Unknown	Unknown
747	2,000	Diesel Fuel	1993	FRP[b]
824	1,000	Waste Oil	1992	Steel[b]
826-1	550	Waste Oil	1992	FRP[b]
826-2	10,000	Gasoline	1992	Steel[b]
826-3	10,000	Gasoline	1992	Steel[b]
826-4	15,000	Gasoline	1987	Steel[b]
869	1,000	Waste Oil	1991	FRP[b]
1247-1	15,000	Gasoline	1991	Steel[b]
1247-2	15,000	Gasoline	1991	Steel[b]
5060	1,000	Diesel Fuel	1992	FRP[b]

Notes: (a) Regulated UST does not meet 1998 compliance standard.
(b) UST meets 1998 compliance standards (double walled with automatic leak detection, spill/overfill protection, corrosion protection, and liquid level monitoring).
FRP = fiberglass-reinforced plastic
UST = underground storage tank

Source: Department of Defense, 1994.

Table G-4. Inventory of Aboveground Storage Tanks (as of March 30, 1994)
Page 1 of 4

Building	Capacity (gallons)	Content	Date of Installation
101	275	Diesel Fuel	1981
107[a]	275	Diesel Fuel	1981
108-1	100	Gasoline	Unknown
108-2	100	Gasoline	Unknown
108-3	550	Diesel Fuel	Unknown
120-1[a]	55	Diesel Fuel	1980
120-2[a]	55	Diesel Fuel	1980
215[a]	275	Diesel Fuel	1971
220-1[a]	275	Diesel Fuel	1981
220-2	1,000	Propane	Unknown
230	275	Diesel Fuel	1981
302-1	50,000	Water	Unknown
304[a]	275	Diesel Fuel	1957
318[a]	150	Diesel Fuel	1980
333	Unknown	Carbon Dioxide	Unknown
336	250	Diesel Fuel	Unknown
337-1	500	Diesel Fuel	Unknown
337-2	500	Diesel Fuel	Unknown
337-3	75,000	Water	Unknown
410[a]	275	Diesel Fuel	1986
422[a]	275	Diesel Fuel	Unknown
426[a]	275	Diesel Fuel	1981
427[a]	275	Diesel Fuel	1981
430[a]	275	Diesel Fuel	1986
431-1	61	Propylene Glycol	Unknown
431-2	61	Propylene Glycol	Unknown
431-3	61	Hydraulic Fluid	Unknown
431-4	61	Hydraulic Fluid	Unknown
431-5	61	Mop Soap	Unknown
431-6	61	Oil	Unknown
431-7	61	Oil	Unknown
431-8	61	Oil	Unknown
431-9	300	Unknown	Unknown
436	15,000	Water	Unknown
501	275	Diesel Fuel	1986
502[a]	275	Diesel Fuel	1986
511[a]	275	Diesel Fuel	1986
521-1[a]	250	Diesel Fuel	1989
521-2	61	Hydraulic Fluid	Unknown
521-3	61	Hydraulic Fluid	Unknown
521-4	61	Hydraulic Fluid	Unknown
521-6	61	Motor Oil	Unknown

Table G-4. Inventory of Aboveground Storage Tanks (as of March 30, 1994)
Page 2 of 4

Building	Capacity (gallons)	Content	Date of Installation
521-7	61	Motor Oil	Unknown
521-8	61	Motor Oil	Unknown
521-9	61	Motor Oil	Unknown
528	1,000	Propane	Unknown
531	275	Diesel Fuel	1986
533-1	100	Diesel Fuel	1992
533-2	61	Lube Oil	Unknown
533-3	61	Lube Oil	Unknown
533-4	61	Lube Oil	Unknown
533-5	61	Lube Oil	Unknown
533-6	61	Lube Oil	Unknown
533-7	61	Lube Oil	Unknown
533-8	61	Lube Oil	Unknown
533-9	61	Lube Oil	Unknown
543	275	Diesel Fuel	1981
603	100	Diesel Fuel	Unknown
604-1	300	Soap	Unknown
604-2	300	Soap	Unknown
610-1	61	Hydraulic Fluid	Unknown
610-2	61	Propylene Glycol	Unknown
610-3	61	Soap	Unknown
610-4	61	Motor Oil	Unknown
610-5	61	Motor Oil	Unknown
610-6	61	Motor Oil	Unknown
610-7	61	Motor Oil	Unknown
610-8	61	Motor Oil	Unknown
612	20	Diesel Fuel	Unknown
624	275	Diesel Fuel	1981
627-1	61	Cleaning Compound	Unknown
627-2	61	Soap	Unknown
627-3	61	Window Fluid	Unknown
627-4	61	Propylene Glycol	Unknown
627-5	61	Motor Oil	Unknown
627-6	61	Hydraulic Fluid	Unknown
627-7	61	Empty	Unknown
627-8	61	Empty	Unknown
627-9	12,655	Propylene Glycol	Unknown
627-10	12,655	Propylene Glycol	Unknown
627-11	10,000	Propylene Glycol	Unknown
642	1,000	Propane	Unknown
664	1,800	Aqueous Film-Forming Foam	Unknown

Table G-4. Inventory of Aboveground Storage Tanks (as of March 30, 1994)
Page 3 of 4

Building	Capacity (gallons)	Content	Date of Installation
670-1	500	Diesel Fuel	1987
670-2	500	Diesel Fuel	1987
670-3	500	Diesel Fuel	1987
708	150	Diesel Fuel	Unknown
709-1	400	Diesel Fuel	Unknown
709-2	400	Diesel Fuel	Unknown
709-3	400	Diesel Fuel	Unknown
709-4	400	Diesel Fuel	Unknown
709-5	61	Motor Oil	Unknown
709-6	61	Motor Oil	Unknown
709-7	61	Motor Oil	Unknown
709-8	61	Motor Oil	Unknown
709-9	61	Motor Oil	Unknown
709-10	61	Motor Oil	Unknown
709-11	61	Motor Oil	Unknown
709-12	61	Motor Oil	Unknown
712-1	275	Diesel Fuel	1986
712-2	275	Diesel Fuel	1986
712-3	100	Diesel Fuel	Unknown
715[b]	200	Diesel Fuel	1979
716[b]	200	Diesel Fuel	1979
717	300	Empty	Unknown
721[b]	200	Diesel Fuel	Unknown
724[b]	200	Diesel Fuel	Unknown
725	275	Diesel Fuel	1981
726	10	Diesel Fuel	Unknown
731	1,000	Propane	Unknown
732	1,000	Propane	Unknown
735	500	Propane	Unknown
822-1	1,000	Propane	Unknown
822-2	1,000	Propane	Unknown
824-1	1,000	Propane	Unknown
824-2	1,000	Propane	Unknown
833-1	275	Diesel Fuel	1986
833-2	275	Diesel Fuel	1986
833-3	275	Diesel Fuel	1986
833-4	1,000	Propane	Unknown
850-1	175	Diesel Fuel	Unknown
850-2	125	Diesel Fuel	Unknown
850-3	1,000	Propane	1976
850-4	1,000	Propane	1976
856-1	6,000	Aluminum Sulfate	1986

Table G-4. Inventory of Aboveground Storage Tanks (as of March 30, 1994)
Page 4 of 4

Building	Capacity (gallons)	Content	Date of Installation
856-2	6,000	Aluminum Sulfate	1986
870-1	50	Diesel Fuel	Unknown
870-2	500	Diesel Fuel	1991
872	1,000	Propane	Unknown
875	1,000	Propane	Unknown
5060[a]	100	Diesel Fuel	Unknown
5062-1	5,000	Liquid Oxygen	Unknown
5062-2	2,000	Liquid Nitrogen	Unknown
5063-1	5,000	Liquid Oxygen	Unknown
5063-2	2,000	Liquid Nitrogen	Unknown
5151	500	Propane	Unknown
7008[c]	5,000	Empty	1976
7009[c]	5,000	Empty	1976
7015	840,000	JP-4	1956
7020[c]	210,000	Diesel Fuel (Empty)	1956
7021	210,000	Propylene Glycol	1956
7023[c]	420,000	JP-4 (Empty)	1956
7024	1,575,000	JP-4	1956
7038	500,000	Water	1956
7058	Unknown	Water	1967
7094	367,500	Diesel Fuel	1974
7095[c]	367,500	Diesel Fuel (Empty)	1974

Notes: (a) A separate 10-gallon day tank associated with an emergency generator is also located at this facility.
(b) Tank is attached to mobile emergency generator.
(c) Inactive.

Table G-5. Inventory of Oil/Water Separators (as of March 30, 1994)

Building	Description	Capacity (gallons)	Waste Oil Capacity
438	Refueling Maintenance	2,500	6,000[a]
530	Vehicle Maintenance	Unknown	500
608	Vehicle Maintenance	3,890	1,000
668	Fuel Cell Maintenance	500	Unknown
869	Sewage Treatment Plant	67,000	1,000[a]
4005	Aircraft Maintenance	4,000	2,000
4008	Jet Engine Test Cell	550	1,000[a]
4009	Integrated Maintenance Facility (WSA)	5,800	2,000[a]
4010	Aircraft Support Equipment Shop/Storage Facility	12,000	2,000
4033	Refueling Vehicle Maintenance	20	1,000[a]
4035	Weapons Training Maintenance	3,000	550
5065	Storm Drain Pump House	Unknown	Unknown
7083	Fire Training Area No. 2	Unknown	Unknown

Note: (a) Wastes stored in separate underground storage tank associated with oil/water separator.
WSA = Weapons Storage Area

Table G-6. Pesticides Inventory

Name	Quantity
Pesticides	
Bay Gon	24 gallons
Combat	58 pounds
Cyno-Gas	5 pounds
Diazinon	6 gallons
Diazinon	12 pounds
Drione	70 pounds
Dursban	7 ounces
Dursban	20 pounds
Dursban	30 gallons
d-Trans Allethrin-Resm	13 gallons
d-Phenethrin	11 gallons
Ficam-W	6 pounds
Malathion	135 gallons
Malathion	130 gallons
Pyrenone	0.3 gallons
Tempo	1 gallon
Sevin	50 pounds
Sevin	225 pounds
PT-240 Perma Dust	95 pounds
PT-250 Baygon	122 pounds
PT-270 Dursban	180 pounds
PT-515 Wasp Freez	17 gallons
PT-565 Pyrethrum Plus	2 gallons
Killmaster II Dursban	3 gallons
Herbicides	
Trimec	19 gallons
Round-up	81 gallons
Simazine	50 pounds
2,4-D	44 gallons
Karmec	240 pounds
Weed & Feed Fertilizer	32,600 pounds[a]
Rodenticide	
Warfrin	100 pounds
Fungicides	
Daconil 2787	250 pounds
Tursan	56 pounds
Termec sp	252 pounds

Note: (a) Material stored at golf course maintenance facility.

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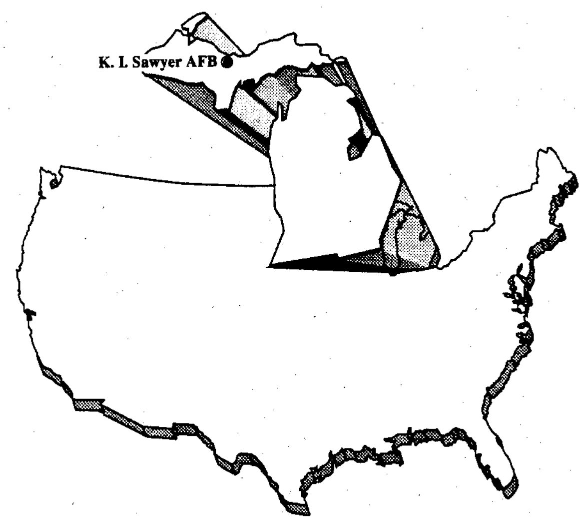

APPENDIX H

APPENDIX H

AIR FORCE POLICY FOR MANAGEMENT OF ASBESTOS-CONTAINING MATERIAL AT CLOSURE BASES AND RESULTS OF K. I. SAWYER AIR FORCE BASE ASBESTOS SURVEY

APPENDIX H

AIR FORCE POLICY FOR MANAGEMENT OF ASBESTOS-CONTAINING MATERIAL (ACM) AT CLOSURE BASES

This policy applies specifically to property being disposed of through the Base Realignment and Closure (BRAC) process and supersedes all previous policy on this matter.

1. REFERENCES

a. Asbestos Hazard Emergency Response Act (AHERA).

b. Federal Tort Claims Act, 28 U.S.C. § 2671.

c. 40 CFR Part 61, Subpart M - National Emission Standards for Hazardous Air Pollutants (NESHAP).

d. 29 CFR Section 1910.1001 - Occupational Safety and Health Administration (OSHA) general industry standard for asbestos.

e. 29 CFR Section 1926.58 - Occupational Safety and Health Administration (OSHA) construction industry standard for asbestos.

f. 40 CFR Part 302 - Designation, Reportable Quantities, and Notification.

g. 41 CFR Section 101-47.304-13 - Federal Property Management Regulations provisions relating to asbestos.

h. AFI 32-1052, Facility Asbestos Management.

i. AFI 32-7066, Environmental Baseline Surveys in Real Estate Transactions.

2. DEFINITIONS

a. **Asbestos** - A group of naturally occurring minerals that separate into fibers, including chrysotile, amosite, crocidolite, asbestiform anthophyllite, asbestiform tremolite, and asbestiform actinolite.

b. **ACM** - Asbestos-Containing Material. Any material containing more than one percent asbestos.

c. **Accredited Asbestos Professional** - Air Force Bioenvironmental Engineer or any other professional who is accredited through EPA's asbestos model accreditation plan or other equivalent method.

3. POLICY

The Air Force will ensure that at the time any property is conveyed, leased, or otherwise disposed of through the Base Realignment and Closure (BRAC) process, it does not pose a threat to human health due to ACM and that the property complies with all applicable statutes and regulations regarding ACM.

a. **Responsibilities**

(1) The Air Force Base Conversion Agency (AFBCA) conducts and funds, from BRAC accounts, any asbestos surveys and remediation needed solely for base closure; to include, but not limited to, additional asbestos surveys for environmental baseline surveys, asbestos repair or resurvey of vacated buildings.

(2) The MAJCOM's conduct and fund asbestos surveys and remediation needed to properly manage asbestos hazards, in accordance with current policy guidelines, up to the time of property management responsibility transfer to AFBCA.

b. **Surveys for ACM.** A survey of facilities for ACM will be accomplished or updated within the 6 months prior to the initial transfer, whether by lease, sale or other disposal method. Surveys will, at a minimum, identify the extent of asbestos contained in facilities and the exposure hazards. Surveys will be accomplished under the supervision of an accredited asbestos professional. These surveys will minimally include the following:

(1) A review of facility records.

(2) A visual inspection.

(3) An intrusive inspection, as directed by an accredited asbestos professional.

(4) Ambient air sampling, if directed by an accredited asbestos professional, in order to determine if any appropriate remedial actions are needed prior to the property being leased or transferred, or to protect facility occupants.

c. **Remediation of ACM.** Remediation of ACM in facilities at closure bases will be in accordance with applicable laws, regulations and standards. Remediation of ACM may be required if, in the judgment of an accredited asbestos professional, at least one of the following criteria apply:

(1) The ACM is of a type, condition, and in a location such that, through normal and expected use of the facility, it will be damaged to the extent that it will produce an asbestos fiber hazard to facility occupants.

(2) The type and condition of the ACM is such that it is not in compliance with appropriate statutes or regulations.

EXCEPTION: Remediation of ACM by AFBCA will not be accomplished if the transferee is willing to conduct remediation in accordance with applicable standards prior to beneficial occupancy as part of the transfer agreement.

d. **Full Disclosure.** AFBCA will make a full disclosure to the extent known of the types, quantities, locations, and condition of ACM in any real property to be conveyed, leased, sold, or otherwise transferred. Results of ambient air sampling will also be disclosed where available. This disclosure will normally be included in appraisal instructions, invitations for bids or offers to purchase, advertisements and contracts for sale, leases, and deeds.

e. **Management of ACM**. ACM remaining in a facility will be managed in-place using commonly accepted standards, criteria, and procedures in compliance with all applicable laws and regulations to assure the protection of human health and the environment. The responsibility for this management will be transferred to the owner or lessee by execution of the appropriate documents.

4. EFFECTIVE DATE

This policy becomes effective on the date signed and remains in effect until superseded.

/s/
Alan P. Babbitt
Acting Deputy Assistant Secretary of the Air Force
(Environment, Safety, and Occupational Health)

3/25/94
Date

This Air Force Policy for Management of Asbestos Containing Material (ACM) at Closure Bases, March 25, 1994, supersedes previous Air Force Policy on management of asbestos dated November 6, 1990, and May 1, 1992, respectively, and has been retyped for purposes of clarity and legibility.

Table H-1. Facilities Surveyed for Asbestos, K. I. Sawyer AFB, 1992
Page 1 of 8

Building	Facility Description	Asbestos-Containing Material (ACM) Present
104	Readiness Crew	No ACM identified
108	Readiness Crew Facility	Albatros underground pipe, flex duct material on furnace
112	Fire Station	No ACM identified
113	Rescue Fire Facility	Roof - asphalt and gravel. Shop area - vinyl composite floor tile
310	Entry Control Facility	Mechanical Room - cold water fitting, hot water piping and fitting, venting duct. Shack - hot water piping, vinyl floor tile. Roof - asphalt and gravel
311	Survival Inspection Shop	Boiler insulation. Domestic cold water pipe suspect due to both positive and negative results of samples taken
317	Rescue Fire Facility	Pool - vinyl composite floor tile. Roof - asphalt and gravel
319	Warehouse Supply	Mechanical Room - hot water fitting. Hot water fitting, vinyl composite floor tile
321	Conventional Munitions Shop	Bomb Room - hot water fitting. Mechanical Room - hot water fitting. Office - hot water fitting. Roof - asphalt and gravel
400	Weapon and Release System Shop	Volk field - pipe insulation (first floor store room). Wall board material. Mechanical room - pipe insulation, hot water converter. Wall sheetrock suspect due to both positive and negative sample results
402	Storage Facility	Mechanical room - pipe insulation. Maintenance bay - pipe insulation. Hot water heating fitting suspect due to both positive and negative sample results
404	Lab/Education Center/Group Headquarters	Grey and brown floor tile. Mechanical room - duct insulation, pipe insulation, high temperature water pipe, insulation, make up water pipe insulation. HVAC system - duct surface suspect due to both positive and negative sample results
405	Maintenance Shop	Store room - Vinyl composite floor tile
406	Operations Building	Mechanical room - pipe insulation
408	Maintenance Shop	Vinyl composite floor tile, mechanical equipment tank, vent duct, hot water fitting

HVAC = heating, ventilating, and air conditioning

Table H-1. Facilities Surveyed for Asbestos, K. I. Sawyer AFB, 1992
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Building	Facility Description	Asbestos-Containing Material (ACM) Present
409	Warehouse	Mechanical room - pipe insulation. Radiator pipe insulation - midline of pipeline, pipe elbow by radiator. Ceiling sheetrock suspect due to both positive and negative sample results.
414	Maintenance Shop	Mechanical room - pipe insulation. Basement - duct insulation (near work area)
417	Warehouse Supply	Sheetrock, ceiling tile, vinyl composite floor tile
419	Warehouse Supply	No ACM identified
420	Explosive Ordnance Disposal Facility	Office - vinyl composite floor tile. Maintenance Bay - vinyl composite floor tile
421	Storage Facility	Pipe insulation, joints, fittings, and elbows, radiator line (near ceiling). Mechanical room - hot water converter line insulation. Exterior electric section - pipe insulation
422	Vehicle Operations	Maintenance Bay - hot water fitting. Mechanical Room - hot water piping and fittings, tank. East Office - vinyl composite floor tile, hot water fitting. Office West - vinyl composite floor tile, hot water fitting. Roof - asphalt and gravel, shingled. Vinyl composite floor tile
424	Maintenance Shop	Hot water heating piping suspect due to both positive and negative sample results
425	Hangar	Maintenance Bay - hot water fitting. Roof - asphalt and gravel
426	Security Police Operations	Mechanical room - wall insulation, hot water converter insulation. Small store room - hot water system insulation. Second floor - northwest corner floor tile. Domestic water fitting insulation and wall sheetrock suspect due to both positive and negative sample results
427	Base Operations	Mechanical room - hot water converter insulation, hot water line insulation, vent duct insulation. Communications room - wallboard
428	Survival Equipment Shop	Mechanical room - pipe insulation. Glued on wall tile and wall sheetrock suspect due to both positive and negative sample results
430	Survival Equipment Shop	Mechanical room - pipe insulation
431	Storage Facility	Pipe insulation (ceiling area by wash section). Mechanical room - high temperature hot water line insulation

Table H-1. Facilities Surveyed for Asbestos, K. I. Sawyer AFB, 1992
Page 3 of 8

Building	Facility Description	Asbestos-Containing Material (ACM) Present
500	Wing Headquarters	Hot water heating fitting suspect due to both positive and negative sample results
501	Communication Facility	Pipe cloth suspect due to both positive and negative sample results
502	Field Training Facility	Mechanical room - hot water line pipe insulation, ceiling tile
503	Chapel Center	Volk field - pipe insulation (Machine Shop). Office - radiator line insulation. Above kitchen area. Domestic water pipe insulation suspect due to both positive and negative sample results
504	Recreation Center	No ACM identified
511	Security Police Operations/ Corrections Facility	Mechanical room - insulation. Office - radiator line insulation
512	Base Personnel Office	Duct insulation
513	Miscellaneous Facility	Office - Vinyl composite floor tile. Roof - shingled
520	Pump Station	Insulation
522	Supply and Equipment Warehouse	Warehouse - pipe insulation (above door), pipe insulation (ceiling heat unit). Steam fitting suspect due to both positive and negative sample results
530	Vehicle Maintenance Shop	Locker room - pipe insulation
531	Base Engineering	Heating/ventilation unit, hot water line. Mechanical room - pipe. Drafting section - radiator line insulation. Planning office - pipe insulation
533	Pavement Ground Facility	Mechanical room - insulation
535	Education Center	Roof - shingled
537	Education Center	Vinyl composite sheet floor. Roof - shingled
538	Education Center	Vinyl composite sheet floor. Roof - shingled
539	Education Center	Vinyl composite sheet floor. Roof - rolled sheet type
600	Fire Station	Pipe insulation, fill hose water line, stall #1 pipe insulation. Mechanical room - hot water line (by right side floor pump), small hot water tank. Hot water heating piping suspect due to both positive and negative sample results
601	Photo Lab	Mechanical room - pipe insulation
603	Utility Vault	Roof - asphalt and gravel

Table H-1. Facilities Surveyed for Asbestos, K. I. Sawyer AFB, 1992
Page 4 of 8

Building	Facility Description	Asbestos-Containing Material (ACM) Present
604	Vehicle Operations	Pipe insulation. Domestic cold water pipe suspect due to both positive and negative sample results
607	Vehicle Operations	Wall sheetrock and vinyl composite sheet floor suspect due to both positive and negative sample results
608	Vehicle Maintenance	No ACM identified
609	Vehicle Shop	Pipe line (garage area). Mechanical room - pipe insulation, hot water distribution line. Latrine - pipe insulation. Utility room - pipe insulation. Domestic water pipe insulation suspect due to both positive and negative sample results
610	Storage Facility	Hot water converter. Mechanical room - pipe insulation. Maintenance bay (over offices) - pipe insulation. Hot water heating fitting suspect due to both positive and negative sample results
611	Security Police	Weapon Storage Area - floor tiles. Hot water heating piping suspect due to both positive and negative sample results
631	Commissary	Pipe insulation, refrigeration suction line, domestic hot water line. Domestic water pipe insulation suspect due to both positive and negative sample results
632	Exchange	Pipe insulation. Wall sheetrock suspect due to both positive and negative sample results
633	Clothing Store	Mechanical room - pipe insulation
634	Commissary	Pipe insulation (near water fountain). Boiler room - insulation. Locker room (men's) - pipe insulation. Wall plaster suspect due to both positive and negative sample results
640	Non-Commissioned Officers' Mess	Mechanical room - hot water line insulation. Vent duct insulation (above ceiling tile)
641	Gymnasium	Hot water line pipe insulation, hot water return line pipe insulation, radiator pipe insulation. Mechanical room - pipe insulation. Domestic water pipe insulation suspect due to both positive and negative sample results
642	Bowling Center	Glued on wall tile suspect due to both negative and positive sample result
661	Maintenance Dock	Wall sheetrock suspect due to both positive and negative sample results
662	Maintenance Dock	Office - vinyl composite floor tile

Table H-1. Facilities Surveyed for Asbestos, K. I. Sawyer AFB, 1992
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Building	Facility Description	Asbestos-Containing Material (ACM) Present
663	Maintenance Dock	Maintenance Bay - hot water fitting. Office - vinyl composite floor tile. Hot water fittings
665	Maintenance Dock	Hot water heating piping suspect due to both positive and negative sample results
666	Maintenance Dock	Maintenance Bay - hot water fitting. Office - vinyl composite floor
667	Corrosion Control Facility	Maintenance Bay - hot water piping and fittings. Office - vinyl composite floor
668	Maintenance Dock	Venting duct, hot water fittings, heat exchanger. Roof - asphalt and gravel. Shop - vent duct, hot water piping and fittings
708	Communication Facility	Floor tile (Room 129), wall panels, hot water line pipe insulation, vent duct insulation, duct insulation (at seam, 2nd floor), white floor tile (back of old rapid repro), red/brown floor tile (back of rapid repro), cream color floor tile (hall), floor tile (Room 317), pegboard (Room 317), ceiling tile, cool water pipe insulation, water coolers outside building. Utility room - air conditioning/heating unit insulation. Mechanical room (3rd floor) - "J" air conditioning/heating system, "F" supply fans, ceiling board, air handler seams. Mechanical room (2nd floor) - duct insulation. Drain-piping system and domestic cold water pipe suspect due to both positive and negative sample results
709	Electrical Power Station	Insulation on stack of retired boiler, pipe insulation in basement (near work area), duct insulation in basement (near work area), pipe insulation (near roll door, east wall), pipe insulation for backup generator, pipe insulation to unit heater, boiler line, pipe insulation to chemical additive unit, mech/boiler room. Duct suspect due to both positive and negative sample results
710	Squadron Operations/Legal Center	Piece of ground pipe in front of building. Heating/ventilation room - insulation. Mechanical room - pipe insulation. Wall plaster suspect due to both positive and negative sample results

Table H-1. Facilities Surveyed for Asbestos, K. I. Sawyer AFB, 1992
Page 6 of 8

Building	Facility Description	Asbestos-Containing Material (ACM) Present
725	Aircraft General Purpose Shop	Brown and cream tile in women's latrine, duct insulation overtop of air compressors, pipe insulation, floor tile and adhesive in electrical hallway, wallboard, floor tiles (old records staging area). Mechanical room - insulation, heating/ventilation elbow, joint fitting, vent insulation, ceiling tile. Hot water heating fitting, domestic water pipe insulation, ceiling sheetrock, and ceiling tile suspect due to both positive and negative sample results
726	Headquarters Wing	No ACM identified
727	Supply and Equipment Warehouse	Mechanical room - insulation, vent duct insulation, raw water line pipe insulation, ceiling insulation. Office - pipe insulation. Hot water heating piping suspect due to both positive and negative sample results
730	Squadron Operations	Airjets in refrigeration shop, air movement system - vent duct insulation, ceiling tile (bay area), hot water line insulation by exit door, air movement system - air handler duct. Mechanical room - insulation, air handler insulation
740	Jet Engine Maintenance	Vent duct insulation (south end of building), pipe insulation (main bay, west end of building)
741	Flight Simulator	Mechanical room - boiler/heater exchange, pipe insulation
800	Officers' Open Mess	Mechanical room - pipe insulation. Pipe insulation behind ice machine. Heat exchanger (mechanical equipment) and domestic water pipe insulation suspect due to both negative and positive sample results
801	Dormitory	Hot water converter. Hot water heating fitting and wall sheetrock suspect due to both positive and negative sample results
802	Visiting Officers' Quarters	Radiator line insulation. Floor tile beneath carpet
803	Officers' Quarters	Pipe insulation (Billeting Room). Room 10 - pipe insulation. Floor tile beneath carpet. Room 3502 - pipe insulation
805	Officers' Quarters	Insulation (hot water converter), pipe insulation. Mechanical room - asbestos material on floor, boiler insulation
810	Dormitory	Pipe insulation (hot water converter), pipe insulation (radiator)

Table H-1. Facilities Surveyed for Asbestos, K. I. Sawyer AFB, 1992
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Building	Facility Description	Asbestos-Containing Material (ACM) Present
811	Dormitory	Pipe insulation (2nd floor near exit). Mechanical room - pipe insulation (hot water supply line), boiler insulation. Hot water heating piping suspect due to both positive and negative sample results
813	Post Office	No ACM identified
814	Airmen's Dormitory	No ACM identified
815	Dormitory	Mechanical room - pipe insulation
816	Animal Clinic	Mechanical room - pipe insulation
817	Social Action Facility	Mechanical room - pipe insulation
819	Theater	Mechanical room - insulation. Mechanical room - pipe insulation. Mechanical room - air handler insulation. Hot water heating piping and textured acoustical ceiling suspect due to both positive and negative sample results
822	Package Storage	No ACM identified
824	Automotive Shop	Soffit on north end of building
825	Arts and Crafts Center	Roof - asphalt and gravel
826	Service Station	Hot water heating fitting suspect due to both positive and negative sample results
830	Dormitory	Mechanical room - high temperature hot water line insulation. Mechanical room - boiler insulation
831	Dormitory	Mechanical room - pipe insulation
832	Dormitory	Pipe insulation (hot water converter)
833	Dining Hall	Radiator line insulation. 2nd floor - pipe insulation. Mechanical room - pipe insulation. Dining hall - duct insulation. Masonite board from building exterior
835	Dormitory	Mechanical Room - hot water piping and fittings, tank. Rooms - vinyl composite floor. Roof - shingled
836	Dormitory	Mechanical Room - hot water piping and fittings, tank. Rooms - vinyl composite floor. Roof - shingled
837	Group Headquarters	Mechanical room - pipe insulation

Table H-1. Facilities Surveyed for Asbestos, K. I. Sawyer AFB, 1992
Page 8 of 8

Building	Facility Description	Asbestos-Containing Material (ACM) Present
850	Medical Composite	Old mechanical room - pipe insulation. Surgery - seamline to vent #3, vent run #3 insulation. Basement - pipe insulation. Surgical nurses station - floor tile. Dental clinic - vinyl floor tile. Steam fitting suspect due to both positive and negative sample results
852	Material Services	No ACM identified
863	Wastewater Treatment Facility	No ACM identified
864	Waste Treatment Facility	Roof - asphalt and gravel
869	Waste Treatment Facility	Vinyl composite floor. Roof - asphalt and gravel
875	Golf Course and Equipment Storage	No ACM identified
947	Youth Center	Radiator pipe insulation. Unknown room - pipe insulation
948	Child Care Center	Roof tile. Mechanical room - boiler/heater exchange
1015	Miscellaneous Building	Vinyl composite floor, venting ducts. Roof - rolled sheet type
1020	Family Housing	Hot water fittings crawl space, sheet rock in walls and ceiling
1200	Transient Lodging Facility	Vinyl composite floor. Roof - shingled
1201	Transient Lodging Facility	Vinyl composite floor. Roof - shingled
1204	Family Sports Center	Vinyl composite floor. Roof - shingled
1211	Red Cross Office	Roof - shingled
1246	Maintenance Shop	Vinyl composite floor, vent duct
1247	Branch Exchange	Vent duct, vinyl composite floor. Roof - asphalt and gravel
1249	Thrift Shop	Vinyl composite floor. Roof - shingled
1250	Chapel	No ACM identified
1375	Youth Center	Mechanical room - boiler/heater exchange
912-1966	Family Housing Units	Each unit type sampled, 78 total units. Each unit contained ACM. Specific records for each facility is available at Civil Engineering

Note: Data for Table H-1 compiled from Galson's 1992 and 1994 asbestos surveys. Results of other asbestos surveys conducted by base personnel for building modification are available from Civil Engineering. These base surveys may not include an entire facility, only portions to be modified.

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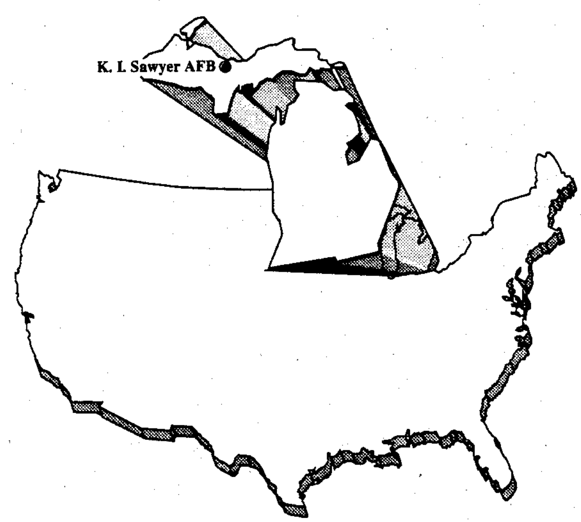


APPENDIX I

APPENDIX I

AIR QUALITY ANALYSIS METHODS AND AIR EMISSIONS INVENTORY FOR K. I. SAWYER AIR FORCE BASE

APPENDIX I

AIR QUALITY ANALYSIS METHODS AND AIR EMISSIONS INVENTORY FOR K. I. SAWYER AFB

CONSTRUCTION EMISSIONS

Construction activities would generate combustive emissions from heavy equipment usage and fugitive dust emissions from ground disturbing activities. Fugitive dust would be generated during construction activities associated with airfield, aviation support, industrial, institutional, commercial, residential, and public facilities/recreation land uses. These emissions would be greatest during site clearing and grading. Uncontrolled fugitive dust (particulate matter) emissions from ground-disturbing activities are emitted at a rate of 1.2 tons per acre per month, or 110 pounds per acre per day (U.S. Environmental Protection Agency, 1985). The particulate matter equal to or less than 10 microns in diameter (PM_{10}) portion of fugitive dust emissions is assumed to be 50 percent, or 55 pounds per acre per working day (acre-day).

Construction for the Proposed Action would disturb a total of approximately 171 acres over the first 5-year period of activity (1995-2000). Assuming that disturbance of the area occurs at the same rate throughout this period, an average of 34.2 acres per year would be disturbed. The analysis of fugitive dust emissions from construction activities assumes an average of 230 working days per year (accounting for weekends, weather, and holidays), and that half of these days (115) would be used for site preparation. Additionally, 4 acre-days of disturbance are assumed per acre. Thus, for the Proposed Action during 1995-2000, the PM_{10} emissions are calculated as follows:

Average daily disturbed acreage:

$$\frac{34.2\text{ acres disturbed}}{\text{year}} \times \frac{4\text{ acre-days of disturbance}}{\text{acre}} \times \frac{1\text{ year}}{115\text{ days}} = 1.19\text{ acres}$$

Average daily PM_{10} emissions:

$$1.19\text{ acres} \times \frac{55\text{ pounds }PM_{10}}{\text{acre-day}} = \frac{65.4\text{ pounds }PM_{10}}{\text{day}} = \frac{0.033\text{ ton }PM_{10}}{\text{day}}$$

Total annual PM_{10} emissions:

$$\frac{65.4\text{ pounds }PM_{10}}{\text{day}} \times \frac{115\text{ days}}{\text{year}} \times \frac{\text{ton}}{2{,}000\text{ pounds}} = 3.76\text{ tons/year}$$

Therefore, the amount of PM_{10} emitted would be 65.4 pounds per day (0.033 ton per day) for 1995-2000. These emissions would produce elevated short-term PM_{10} concentrations, would be temporary, and would fall off rapidly with distance from the source. Similar calculations for fugitive dust emissions were performed for construction activities related to other alternatives. The results of these PM_{10} fugitive dust calculations are summarized in Table I-1. (All tables are at the end of this appendix.)

Construction combustive emissions are estimated using the following pound-per-acre emission factors developed for a medium-scaled construction scenario that includes site preparation, new facility construction, and related infrastructure development.

Pollutant	Pounds Per Acre
Nitrogen oxides (NO_x)	1,095
Carbon monoxide (CO)	3,820
Sulfur oxides (SO_x)	100
PM_{10}	85
Volatile organic compounds (VOCs)	290

Construction combustive emissions associated with each alternative are summarized by time period in Table I-1. Since construction equipment is assumed to be active 230 days per year, annual emissions are equal to daily emissions multiplied by 230.

AIRCRAFT OPERATION EMISSIONS

Emissions for the following aircraft activities were calculated from fleet mix and operational information inherent to each alternative: idling at gates, runway climb and approach, taxi-in and taxi-out, touch and go, runway queuing, takeoffs and landings, and engine run-ups. All aircraft emissions were calculated with the Emissions and Dispersion Modeling System (EDMS) model (Segal, 1988a, 1988b, and 1991), which contains a built-in database of U.S. Environmental Protection Agency (EPA) AP-42 emission factors for various types of aircraft. EDMS was also used to calculate downwind pollutant concentrations that would occur from aircraft operations associated with each alternative. Aircraft operation emissions are summarized in Table I-2.

MOTOR VEHICLE EMISSIONS

Motor vehicle emissions were estimated using emission factors from MOBILE 5.0A, the average number of daily trips generated, and the average daily vehicle miles traveled (VMT). MOBILE 5.0A is the latest version of the U.S. EPA-approved model used to estimate emission factors for on-road mobile sources. For preclosure conditions, VMT for the military fleet was estimated

from fuel use records, while VMT for civilian vehicles was based on the number of employees and an assumption of 30 miles per day round-trip travel. A similar assumption of 30 miles per vehicle per day was used for closure conditions. For reuse-related alternatives, the U.S. EPA default values for vehicle mileage mix, tampering rates, mileage accumulation, and exhaust emission rates were used. In addition, the lack of Stage II vapor recovery systems and vehicle anti-tampering and inspection and maintenance programs in the state of Michigan were taken into account. The monthly averages of daily minimum and maximum temperature were averaged for the four quarters of the year. These quarterly averages were used to correct emission factors on a quarterly basis. To estimate the mileage, it was assumed that each one-way vehicle trip associated with a reuse alternative was an average of 15 miles. A summary of the mobile source emissions is presented in Table I-3 for preclosure, closure, and reuse alternative conditions.

OTHER BASE AND/OR REUSE OPERATIONS EMISSIONS

Emissions from sources other than construction activities, aircraft operations, or motor vehicles can be lumped together and called "Other Operation Emissions." These Other Operation Emissions occur from a variety of point and area sources.

The only emissions data available from the state of Michigan for Marquette County were for point sources. Some area and mobile source data are available from U.S EPA's Graphical Aerometric Data System (EGADS); however the data are incomplete. Approximately 98.5 percent of estimated NO_x, CO, sulfur dioxide (SO_2), PM_{10}, and VOC emissions in the Marquette County point source emissions database can be attributed to four sources: Marquette Board of Light and Power, Wisconsin Electric Power Company, Tilden Magnetite Partnership, and Empire Iron Mining Partnership. The first two sources are power production companies, while the last two are mining companies. K. I. Sawyer AFB contributes 1.38 percent of the emissions found in the point source emissions database. Emissions from the remaining 0.12 percent of sources are negligible when compared to the four major sources. Because a disproportionate amount of point source emissions comes from four sources, and because of the lack of area source emissions data for Marquette County, per capita emission factors could not be used to estimate point and area source emissions that would be associated with the operational phase of the reuse alternatives. However, it was assumed that reuse-related point and area source emissions would be less than the sum of the preclosure base emissions since fewer direct employees are associated with each reuse alternative (see Table I-4). The Proposed Action employment total in 2005 is only 3,551 for this comparison. The 1,563 employees associated with the heavy industrial land use are not included since point and area source emissions of heavy industrial land use are calculated separately as discussed in the next section.

It was also assumed that under the Proposed Action, International Wayport, and Commercial Aviation alternatives, the quantity and type of fuel consumption and processing for the existing heating plant would remain unchanged from preclosure operation levels. Under the Recreation Alternative, the heating plant would be converted to an electric generating facility. It was assumed that fuel use for the electric generating facility would be comparable to the existing heating plant, or that the facility would be converted to natural gas. No other major stationary sources are expected to be associated with the reuse alternatives.

HEAVY INDUSTRIAL LAND USE EMISSIONS - PROPOSED ACTION

Emissions from the heavy industrial land use area planned as part of the Proposed Action were calculated separately since these emissions would be potentially significant in magnitude. An indicator-based emission factor was developed from data contained in EGADS for industry types found in the state of Michigan. EGADS is a PC-based data retrieval program containing point source data from U.S. EPA's Aerometric Information Retrieval System (AIRS) and point, area, and mobile source data from U.S. EPA's 1990 Interim Emissions Inventory.

Per-employee point source emission factors were developed from data available for industry sources by summing the reported emissions and dividing by the total number of employees associated with the industries. It was assumed that the resulting per-employee factors could be multiplied by the estimate by employee for the Proposed Action heavy industrial land use area to provide reasonable estimates of the Proposed Action heavy industrial land use point source emissions. The point source emission factors and calculated emissions are presented in Table I-5. No point source data were reported in EGADS for PM_{10}. It is assumed that future PM_{10} point source emissions associated with the Proposed Action heavy industrial land use area will be well controlled and negligible in magnitude.

Area and off-road mobile source emissions associated with the Proposed Action heavy industrial land use area were also calculated from information contained in the EGADS database. Per-employee area/off-road mobile source emission factors were developed by summing the area/off-road mobile source emissions data reported for all Standard Industrial Classification (SIC) codes representative of industry in the state of Michigan and dividing by the total number of employees associated with these industries. The major emission source types considered in this manner included stationary fuel combustion, off-highway vehicles, food production, wood products, various industrial processes, surface coating operations, degreasing, solvent use for various industries, bulk petroleum storage, and on-site incineration and waste burning. The area/off-road mobile source emission factors and calculated emissions are presented in Table I-5. No area/off-road mobile source data were reported in EGADS for SO_2 or PM_{10}.

It is assumed that future SO_2 and PM_{10} area and off-road mobile source emissions associated with the Proposed Action heavy industrial land use will be negligible in magnitude.

EMISSIONS SUMMARY

Compared to preclosure conditions, the number of jobs at K. I. Sawyer AFB would decrease under the various reuse scenarios (excludes employees associated with the Proposed Action heavy industrial land use). Therefore, the point and area source emissions associated with each reuse alternative were assumed to be less than the preclosure point and area source emissions from K. I. Sawyer AFB. As such, the emissions from sources other than construction activities, aircraft operations, and mobile sources were not calculated for the reuse alternatives. Instead, as a conservative assumption for the Proposed Action, International Wayport Alternative, and Commercial Aviation Alternative, the emissions of point and area sources other than construction, aircraft, and mobile sources were assumed to be the same as during preclosure at the base. The same assumption was used for the Recreation Alternative except that Aerospace Ground Equipment emissions were not included. For closure conditions, heating and power production emissions were assumed to be approximately 20 percent of preclosure levels. Point and area source emissions associated with the Proposed Action heavy industrial land use were calculated separately.

The sum of the construction, aircraft operation, motor vehicle, and other operation emissions (including heavy industrial land use area emissions for the Proposed Action) was evaluated to determine how the emissions would affect continued maintenance of the National Ambient Air Quality Standards (NAAQS). The summations of pollutant emissions are presented for preclosure, closure, and each reuse alternative in Tables I-6 through I-10 for nitrogen dioxide (NO_2), CO, SO_2, PM_{10}, and VOCs, respectively.

Table I-1. Construction Emissions Associated with All Alternatives (tons/day)

		Proposed Action[a]		International Wayport Alternative[b]		Commercial Aviation Alternative[c]		Recreation Alternative[d]		No-Action Alternative[e]	
Pollutant	Source	2000	2005	2000	2005	2000	2005	2000	2005	2000	2005
NO_2	Combustive Emissions	0.081	0.081	0.075	0.022	0.113	0.003	0.047	0.047	0.000	0.000
CO	Combustive Emissions	0.284	0.282	0.261	0.078	0.394	0.012	0.164	0.164	0.000	0.000
SO_2	Combustive Emissions	0.007	0.007	0.007	0.002	0.010	0.000	0.004	0.004	0.000	0.000
PM_{10}	Combustive Emissions	0.006	0.006	0.006	0.002	0.009	0.000	0.004	0.004	0.000	0.000
	Fugitive Dust Emissions	0.033	0.033	0.030	0.009	0.045	0.001	0.019	0.019	0.000	0.000
VOCs	Combustive Emissions	0.022	0.021	0.020	0.006	0.030	0.001	0.012	0.012	0.000	0.000

Notes:
(a) Proposed Action emissions based on a total disturbance area of 171 acres during 1995-2000, and 170 acres during 2000-2005.
(b) International Wayport Alternative emissions based on a total disturbance area of 157 acres during 1995-2000, and 47 acres during 2000-2005.
(c) Commercial Aviation Alternative emissions based on a total of 237 acres disturbed by construction during 1995-2000, and 7 acres disturbed during 2000-2005.
(d) Recreation Alternative emissions based on a total disturbance area of 99 acres during 1995-2000, and 98 acres disturbed during 2000-2005.
(e) No-Action Alternative emissions based on no land being disturbed during 1995-2000 and 2000-2005.

CO = carbon monoxide
NO_2 = nitrogen dioxide
PM_{10} = particulate matter equal to or less than 10 microns in diameter
SO_2 = sulfur dioxide
VOCs = volatile organic compounds

Table I-2. Aircraft Operation Emissions (tons/day)
Page 1 of 2

				Proposed Action		International Wayport Alternative		Commercial Aviation Alternative	
Pollutant	Source	Preclosure 1992	Closure 1995	2000	2005	2000	2005	2000	2005
NO_2	Aircraft Flying Operations								
	Military	0.340	0.00	0.001	0.001	0.001	0.001	0.000	0.000
	Civilian	0.001	0.00	0.147	0.159	0.438	0.931	0.011	0.013
	Aircraft Ground Operations								
	Military	0.251	0.00	0.000	0.000	0.000	0.000	0.000	0.000
	Civilian	0.000	0.00	0.000	0.000	0.018	0.039	0.000	0.000
	Total Aircraft Operations	0.592	0.00	0.148	0.160	0.457	0.971	0.011	0.013
CO	Aircraft Flying Operations								
	Military	1.757	0.00	0.011	0.011	0.011	0.011	0.000	0.000
	Civilian	0.010	0.00	0.750	0.877	0.771	1.296	0.663	0.776
	Aircraft Ground Operations								
	Military	1.196	0.00	0.000	0.000	0.000	0.000	0.000	0.000
	Civilian	0.000	0.00	0.001	0.002	0.006	0.014	0.000	0.000
	Total Aircraft Operations	2.963	0.00	0.762	0.890	0.788	1.321	0.663	0.776
SO_2	Aircraft Flying Operations								
	Military	0.037	0.00	0.000	0.000	0.000	0.000	0.000	0.000
	Civilian	0.000	0.00	0.007	0.008	0.018	0.037	0.002	0.003
	Aircraft Ground Operations								
	Military	0.026	0.00	0.000	0.000	0.000	0.000	0.000	0.000
	Civilian	0.000	0.00	0.000	0.000	0.000	0.001	0.000	0.000
	Total Aircraft Operations	0.063	0.00	0.007	0.008	0.018	0.038	0.002	0.003

Table I-2. Aircraft Operation Emissions (tons/day)
Page 2 of 2

				Proposed Action		International Wayport Alternative		Commercial Aviation Alternative	
Pollutant	Source	Preclosure 1992	Closure 1995	2000	2005	2000	2005	2000	2005
PM_{10}	Aircraft Flying Operations								
	Military	0.413	0.00	0.000	0.000	0.000	0.000	0.000	0.000
	Civilian	0.000	0.00	0.013	0.015	0.011	0.023	0.011	0.012
	Aircraft Ground Operations								
	Military	0.027	0.00	0.000	0.000	0.000	0.000	0.000	0.000
	Civilian	0.000	0.00	0.000	0.000	0.000	0.000	0.000	0.000
	Total Aircraft Operations	0.440	0.00	0.013	0.015	0.011	0.023	0.011	0.012
VOCs	Aircraft Flying Operations								
	Military	1.249	0.00	0.002	0.002	0.002	0.002	0.000	0.000
	Civilian	0.001	0.00	0.082	0.089	0.052	0.187	0.066	0.073
	Aircraft Ground Operations								
	Military	0.771	0.00	0.000	0.000	0.000	0.000	0.000	0.000
	Civilian	0.000	0.00	0.001	0.001	0.001	0.002	0.000	0.000
	Total Aircraft Operations	2.021	0.00	0.085	0.092	0.055	0.191	0.066	0.073

CO = carbon monoxide
NO_2 = nitrogen dioxide
PM_{10} = particulate matter equal to or less than 10 microns in diameter
SO_2 = sulfur dioxide
VOCs = volatile organic compounds

Table I-3. Mobile Source Emissions (tons/day)

Alternative	Year	NO_x	CO	VOCs
Preclosure				
Civilian	1992	0.311	2.319	0.216
Military (Gas)	1992	0.020	0.156	0.014
Military (Diesel)	1992	0.013	0.005	0.001
Total		0.344	2.480	0.231
Closure	1995	0.003	0.024	0.002
Proposed Action	2000	0.246	1.701	0.169
	2005	0.450	2.982	0.295
International Wayport	2000	0.397	2.742	0.272
	2005	0.528	3.501	0.346
Commercial Aviation	2000	0.202	1.399	0.139
	2005	0.337	2.232	0.221
Recreation	2000	0.072	0.499	0.049
	2005	0.116	0.767	0.076
No-Action	2000	0.003	0.024	0.002
	2005	0.003	0.022	0.002

Note: SO_2 and PM_{10} emissions from mobile sources are negligible.
CO = carbon monoxide
NO_x = nitrogen oxides
VOC = volatile organic compound

Table I-4. Emission Indicators Associated with K. I. Sawyer AFB

	Preclosure	Closure	Proposed Action		International Wayport Alternative		Commercial Aviation Alternative		Recreation Alternative		No-Action Alternative	
Indicator	1992	1995	2000	2005	2000	2005	2000	2005	2000	2005	2000	2005
Direct Employment	4,567	50	2,718[b]	5,114[c]	1,539	2,386	1,085	1,700	405	631	50	50
Site-Related Population	15,485[a]	183[a]	14,176	27,800	7,543	12,226	5,410	8,729	1,719	2,774	183	183
24-Hour Traffic VMT[d]	145,710	1,500	133,200	258,480	214,770	303,480	109,575	193,485	39,045	66,495	1,875	1,875
Aircraft LTOs												
Daily	52	0	49	55	53	88	44	50	0	0	0	0
Peak Hour	5	0	5	5	5	9	4	5	0	0	0	0
Aircraft Touch-and-Gos												
Daily	96	0	15	17	9	11	14	16	0	0	0	0
Peak Hour	14	0	1	2	1	1	1	2	0	0	0	0

Notes: (a) Does not include retired military.
(b) Includes 781 employees associated with heavy industrial land use.
(c) Includes 1,563 employees associated with heavy industrial land use.
(d) Assumes an average one-way vehicle trip length of 15 miles.
LTO = landing and takeoff
VMT = vehicle miles traveled

Table I-5. Heavy Industrial Land Use Emissions Associated with the Proposed Action

Heavy Industrial Land Use Category	Year	Employees	VOCs	NO_x	CO	SO_2	PM_{10}
Point Sources;[a] tons/year	NA	585,975	32,926	10,214	41,587	7,166	ND
Per Employee Point Source Factor; tons/employee/year	NA	NA	0.05619	0.01743	0.07097	0.01223	--
Area/Off-Road Mobile Sources;[b] tons/year	NA	585,975	140,622	37,801	32,029	ND	ND
Per Employee Area/Off-Road Mobile Source Factor; tons/employee/year	NA	NA	0.23998	0.06451	0.05466	--	--
Proposed Action Point Source Emissions; tons/year (tons/day)	2000	781	43.90 (0.12)	13.60 (0.04)	55.40 (0.15)	9.60 (0.03)	--
	2005	1,563	87.80 (0.24)	27.20 (0.07)	110.90 (0.30)	19.10 (0.05)	--
Proposed Action Area/ Off-Road Mobile Source Emissions; tons/year (tons/day)	2000	781	187.40 (0.51)	50.40 (0.14)	42.70 (0.12)	--	--
	2005	1,563	375.10 (1.03)	100.80 (0.28)	85.40 (0.23)	--	--
Total Proposed Action Emissions; tons/year (tons/day)	2000	781	231.30 (0.63)	64.00 (0.18)	98.10 (0.27)	9.60 (0.03)	--
	2005	1,563	462.90 (1.27)	128.00 (0.35)	196.30 (0.53)	19.10 (0.05)	--

Notes: (a) Point source emissions are based on data available from the U.S. EPA's Graphical Aerometric Data System (EGADS) for industries in the state of Michigan.
(b) Area/off-road mobile source emissions are based on data available from EGADS for all Standard Industrial Classification (SIC) codes typical of industry in the state of Michigan.

NA = not applicable
ND = no data
CO = carbon monoxide
NO_x = nitrogen oxides
PM_{10} = particulate matter equal to or less than 10 microns in diameter
SO_2 = sulfur dioxide
VOC = volatile organic compound

Table I-6. K. I. Sawyer AFB - Emissions Inventory for Nitrogen Oxides (tons/day)

	Preclosure	Closure	Proposed Action		International Wayport Alternative		Commercial Aviation Alternative		Recreation Alternative		No-Action Alternative	
Source	1992	1995	2000	2005	2000	2005	2000	2005	2000	2005	2000	2005
Aircraft Operations	0.592	0.000	0.148	0.160	0.457	0.971	0.011	0.013	0.000	0.000	0.000	0.000
Construction	N/A	N/A	0.081	0.081	0.075	0.022	0.113	0.003	0.047	0.047	0.000	0.000
Motor Vehicle	0.344	0.003	0.246	0.450	0.397	0.528	0.202	0.337	0.072	0.116	0.003	0.003
Other Operation Sources	0.295	0.038	0.475[a]	0.645[b]	0.295	0.295	0.295	0.295	0.190	0.190	0.038	0.038
Total	1.231	0.041	0.950	1.336	1.224	1.816	0.621	0.648	0.309	0.353	0.041	0.041

Notes: (a) Includes 0.18 ton per day from industrial land use.
(b) Includes 0.35 ton per day from industrial land use.
N/A = not available

Table I-7. K. I. Sawyer AFB - Emissions Inventory for Carbon Monoxide (tons/day)

	Preclosure	Closure	Proposed Action		International Wayport Alternative		Commercial Aviation Alternative		Recreation Alternative		No-Action Alternative	
Source	1992	1995	2000	2005	2000	2005	2000	2005	2000	2005	2000	2005
Aircraft Operations	2.963	0.000	0.762	0.890	0.788	1.321	0.663	0.776	0.000	0.000	0.000	0.000
Construction	N/A	N/A	0.284	0.282	0.261	0.078	0.394	0.012	0.164	0.163	0.000	0.000
Motor Vehicle	2.480	0.024	1.701	2.982	2.742	3.501	1.399	2.232	0.499	0.767	0.024	0.022
Other Operation Sources	0.414	0.038	0.684[a]	0.944[b]	0.414	0.414	0.414	0.414	0.189	0.189	0.038	0.038
Total	5.857	0.062	3.431	5.098	4.205	5.314	2.870	3.434	0.852	1.119	0.062	0.060

Notes: (a) Includes 0.27 ton per day from industrial land use.
(b) Includes 0.53 ton per day from industrial land use.
N/A = not available

Table I-8. K. I. Sawyer AFB - Emissions Inventory for Sulfur Dioxide (tons/day)

	Preclosure	Closure	Proposed Action		International Wayport Alternative		Commercial Aviation Alternative		Recreation Alternative		No-Action Alternative	
Source	1992	1995	2000	2005	2000	2005	2000	2005	2000	2005	2000	2005
Aircraft Operations	0.063	0.000	0.007	0.008	0.018	0.038	0.002	0.003	0.000	0.000	0.000	0.000
Construction	N/A	N/A	0.007	0.007	0.007	0.002	0.010	0.000	0.004	0.004	0.000	0.000
Motor Vehicle	--	--	--	--	--	--	--	--	--	--	--	--
Other Operation Sources	0.346	0.068	0.376[a]	0.396[b]	0.346	0.346	0.346	0.346	0.342	0.342	0.068	0.068
Total	0.409	0.068	0.390	0.411	0.371	0.386	0.358	0.349	0.346	0.346	0.068	0.068

Notes: (a) Includes 0.03 ton per day from industrial land use.
(b) Includes 0.05 ton per day from industrial land use.
N/A = not available

Table I-9. K. I. Sawyer AFB - Emissions Inventory for Particulate Matter (tons/day)

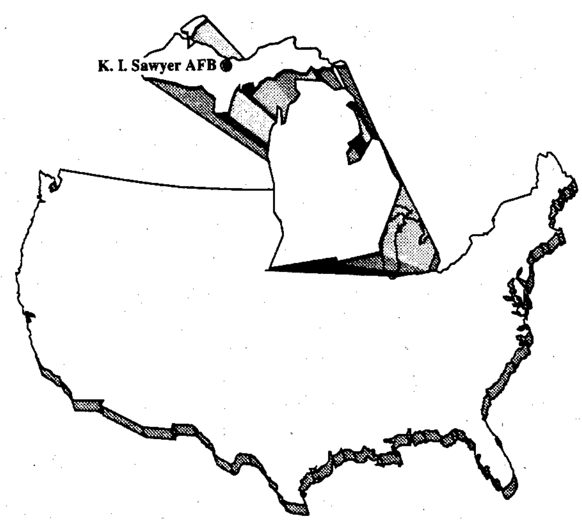
	Preclosure	Closure	Proposed Action		International Wayport Alternative		Commercial Aviation Alternative		Recreation Alternative		No-Action Alternative	
Source	1992	1995	2000	2005	2000	2005	2000	2005	2000	2005	2000	2005
Aircraft Operations	0.440	0.000	0.013	0.015	0.011	0.023	0.011	0.012	0.000	0.000	0.000	0.000
Construction	N/A	N/A	0.039	0.039	0.036	0.011	0.054	0.001	0.023	0.023	0.000	0.000
Motor Vehicle	--	--	--	--	--	--	--	--	--	--	--	--
Other Operation Sources	0.007	0.000	0.007	0.007	0.007	0.007	0.007	0.007	0.001	0.001	0.000	0.000
Total	0.447	0.000	0.059	0.061	0.054	0.041	0.072	0.020	0.024	0.024	0.000	0.000

N/A = not available

Table I-10. K. I. Sawyer AFB - Emissions Inventory for Volatile Organic Compounds (tons/day)

	Preclosure	Closure	Proposed Action		International Wayport Alternative		Commercial Aviation Alternative		Recreation Alternative		No-Action Alternative	
Source	1992	1995	2000	2005	2000	2005	2000	2005	2000	2005	2000	2005
Aircraft Operations	2.021	0.000	0.085	0.092	0.055	0.191	0.066	0.073	0.000	0.000	0.000	0.000
Construction	N/A	N/A	0.022	0.021	0.020	0.006	0.030	0.001	0.012	0.012	0.000	0.000
Motor Vehicle	0.231	0.002	0.169	0.295	0.272	0.346	0.139	0.221	0.049	0.076	0.002	0.002
Other Operation Sources	0.166	0.001	0.796[a]	1.436[b]	0.166	0.166	0.186	0.166	0.152	0.152	0.001	0.001
Total	2.418	0.003	1.072	1.844	0.513	0.709	0.421	0.461	0.213	0.240	0.003	0.003

Notes: (a) Includes 0.63 ton per day from industrial land use.
(b) Includes 1.27 tons per day from industrial land use.
N/A = not available



APPENDIX J

APPENDIX J

NOISE

APPENDIX J

NOISE

1.0 DESCRIPTION OF PROPOSED ALTERNATIVES

1.1 PRECLOSURE

Typical noise sources on and around airfields usually include aircraft, surface traffic, and other human activities.

Military aircraft operations are the primary source of noise in the vicinity of K. I. Sawyer Air Force Base (AFB). The air operations and noise contours for preclosure are taken from the Air Installation Compatible Use Zone study (U.S. Air Force, 1993) for K. I. Sawyer AFB. The contours for preclosure operations are shown in Figure 3.4-4 in Section 3.4.4 (Noise) of this Environmental Impact Statement (EIS). In airport analyses, areas exposed to a day-night average sound level (DNL) of 65 decibels (dB) are considered in land use compatibility planning and impact assessment; therefore, these areas were of particular interest.

The surface traffic noise levels in the vicinity of the base were established in terms of DNL by modeling the arterial roadways near the base using current traffic and speed characteristics. Annual average daily traffic (AADT) data, traffic mix, road width, speed, and day/night split were developed in the traffic engineering study presented in Section 3.2.3, Transportation, and were used to estimate preclosure noise levels. The traffic data used in the analysis are presented in Table J-1. The noise levels generated by surface traffic were predicted using the model published by the Federal Highway Administration (FHWA) (1978). The noise levels are estimated as a function of distance from the centerline of the nearest road. Number of residents impacted was determined from aerial photographs dated November 9, 1991 and U. S. Geological Survey (USGS) maps dated photo revised 1975 and provisional 1985.

1.2 CLOSURE BASELINE

At closure, it is assumed that there would be no aircraft activity.
The noise levels projected for the closure baseline for surface traffic were calculated using the traffic projections at base closure. The AADTs used for the analysis are presented in Table J-1.

Table J-1. Surface Traffic Operations for Total Traffic Volumes (Preclosure and Closure)

Roadway	Segment	Annual Average Daily Traffic	Speed Assumed (mph)	Rd. Width Assumed (no. of lanes)	Day/Night Split (percent)	Percentage Trucks Medium/Heavy
Preclosure						
CR 462	Main Gate to CR 553	5,580	45	2	89/11	0.5/0.5
CR 460	Gate 2 to CR 545	1,840	55	2	89/11	2.1/0.6
CR 460	CR 545 to U.S. 41	1,400	55	2	89/11	2.1/0.6
CR 480	West of CR 553	3,935	55	2	89/11	2.4/5.8
CR 480	CR 553 to U.S. 41	2,500	55	2	89/11	2.4/5.8
CR 553	Marquette city limits to CR 480	5,800	55	2	89/11	2.8/2.9
CR 553	CR 480 to CR 462	6,040	55	2	89/11	2.8/2.9
CR 553	CR 462 to Southgate Drive	6,570	55	2	89/11	2.8/2.9
CR 553	Southgate Drive to SH 35	3,790	55	2	89/11	2.8/2.9
CR 545	U.S. 41 to CR 460	890	45	2	89/11	2.1/1.6
CR 545	CR 460 to CR 456	210	45	2	89/11	2.1/1.6
CR 456	SH 35 to CR 545	1,750	55	2	89/11	2.1/1.6
CR 456	CR 545 to U.S. 41	515	55	2	89/11	2.1/1.6
U.S. 41	SH 28 to Skandia	5,700	55	2	89/11	3.9/4.2
U.S. 41	Skandia to SH 94	3,800	55	2	89/11	3.9/4.2
U.S. 41	SH 94 to CR 456	2,000	55	2	89/11	3.9/4.2
SH 35	CR 553 to CR 456	2,500	55	2	89/11	2.6/2.3
SH 35	CR 456 to Morbit Lake Access	730	55	2	89/11	2.6/2.3
Closure						
CR 462	Main Gate to CR 553	100	45	2	89/11	0.5/0.5
CR 460	Gate 2 to CR 545	25	55	2	89/11	2.1/0.6
CR 460	CR 545 to U.S. 41	1,365	55	2	89/11	2.1/0.6
CR 480	West of CR 553	3,870	55	2	89/11	2.4/5.8
CR 480	CR 553 to U.S. 41	2,810	55	2	89/11	2.4/5.8
CR 553	Marquette city limits to CR 480	4,980	55	2	89/11	2.8/2.9
CR 553	CR 480 to CR 462	4,695	55	2	89/11	2.8/2.9
CR 553	CR 462 to Southgate Drive	4,370	55	2	89/11	2.8/2.9
CR 553	Southgate Drive to SH 35	3,150	55	2	89/11	2.8/2.9
CR 545	U.S. 41 to CR 460	800	45	2	89/11	2.1/1.6
CR 545	CR 460 to CR 456	100	45	2	89/11	2.1/1.6
CR 456	SH 35 to CR 545	1,830	55	2	89/11	2.1/1.6
CR 456	CR 545 to U.S. 41	440	55	2	89/11	2.1/1.6
U.S. 41	SH 28 to Skandia	6,205	55	2	89/11	3.9/4.2
U.S. 41	Skandia to SH 94	4,070	55	2	89/11	3.9/4.2
U.S. 41	SH 94 to CR 456	2,250	55	2	89/11	3.9/4.2
SH 35	CR 553 to CR 456	1,700	55	2	89/11	2.6/2.3
SH 35	CR 456 to Morbit Lake Access	820	55	2	89/11	2.6/2.3

CR = County Road
MPH = miles per hour
SH = State Highway
U.S.# = U.S. Highway

1.3 PROPOSED ACTION

The Proposed Action for the reuse of K. I. Sawyer AFB would result in a comprehensive reuse plan centered on a mixed-use civil aviation facility. Primary components of the aviation action include air passenger operations, air cargo, maintenance, and general aviation operations. Non-aviation land uses include industrial, commercial, institutional, residential, public facilities/recreation, and military lands.

The fleet mix and annual aircraft operations for each of the modeled years are contained in Table J-2. The DNL contours for the proposed flight operations and the proposed flight tracks modeled are presented in Section 4.4.4, Noise. The day-night split for all aircraft operations is shown in Table J-3. Stage lengths for aircraft operations are given in Table J-4.

Engine runup operations were assumed to occur at the southeast corner of the apron. The number of runup operations is presented in Table J-5. During typical runup operations, the engines would run for 20 minutes at idle power and 5 minutes at departure power. It was assumed that no noise suppression facilities would be available. The aircraft were assumed to have a heading of 20 degrees.

General aviation operations were divided into four types:

- Single-engine, piston-driven propeller - A composite single-engine propeller (COMSEP) plane was modeled.
- Multi-engine, piston-driven propeller - Beech Baron 58P assumed to be a typical multi-engine propeller plane.
- Turboprop - Beech King Air assumed to be a typical turboprop.
- Turbofan - Gulfstream IV assumed to be a typical turbofan.

The touch and go patterns and the initial departure and final approach flight tracks used in the modeling are shown in Figure J-1. The touch and go flight tracks were based on those in common usage at similar sized airports. Touch and go operations were assumed to consist of 41 percent of all single-engine piston and 16 percent of multi-engine piston general aviation operations and were split 50/50 on two tracks (one for runway 01 and one for runway 19). Daily operations assigned to each flight track and time period for the Proposed Action are provided in Table J-6 for each of the study years. Assignments were made in a similar way for the other alternatives.

Table J-2a. Annual Operations for the Proposed Action (2000)

Type of Aircraft	Number of Operations	Percent of Category	Total for Category	Category Percent of Total
Air Carrier			11,600	25.1
Beech 1900	2,552	22		
Saab 340	232	2		
ATR-42	8,352	72		
ATR-72	464	4		
Air Cargo			3,000	6.5
757	1,500	50		
MD-11	1,000	33.3		
747-400	500	16.7		
Aircraft Maintenance			600	1.3
Beech 1900	300	50		
ATR-42	300	50		
ATR-72	0	0		
General Aviation			30,700	66.5
Single Engine	23,700	77.2		
Multi-engine	5,000	16.3		
Turboprop	1,000	3.3		
Turbojet	1,000	3.3		
Military			288	0.6
CF-5	96	33.3		
CT-33	13	4.5		
CF/FA-18	25	8.7		
CT-114	70	24.3		
F-16	50	17.4		
UH-1	34	11.8		
Total			46,188	

Table J-2b. Annual Operations for the Proposed Action (2005)

Type of Aircraft	Number of Operations	Percent of Category	Total for Category	Category Percent of Total
Air Carrier			13,000	24.9
Beech 1900	2,600	20		
Saab 340	650	5		
ATR-42	9,100	70		
ATR-72	650	5		
Air Cargo			3,000	5.8
757	1,000	33.3		
MD-11	1,000	33.3		
747-400	1,000	33.3		
Aircraft Maintenance			750	1.4
Beech 1900	300	40		
ATR-42	300	40		
ATR-72	150	20		
General Aviation			35,100	67.3
Single Engine	26,500	75.5		
Multi-engine	6,300	17.9		
Turboprop	1,300	3.7		
Turbojet	1,000	2.8		
Military			288	0.6
CF-5	96	33.3		
CT-33	13	4.5		
CF/FA-18	25	8.7		
CT-114	70	24.3		
F-16	50	17.4		
UH-1	34	11.8		
Total			52,138	

Table J-2c. Annual Operations for the Proposed Action (2015)

Type of Aircraft	Number of Operations	Percent of Category	Total for Category	Category Percent of Total
Air Carrier			15,500	23.8
Beech 1900	2,325	15		
Saab 340	1,085	7		
ATR-42	10,540	68		
ATR-72	1,550	10		
Air Cargo			3,000	4.6
757	500	16.7		
MD-11	1,000	33.3		
747-400	1,500	50		
Aircraft Maintenance			900	1.4
Beech 1900	150	16.7		
ATR-42	450	50		
ATR-72	300	33.3		
General Aviation			45,400	69.8
Single Engine	34,000	74.9		
Multi-engine	8,500	18.7		
Turboprop	1,700	3.7		
Turbojet	1,200	2.6		
Military			288	0.4
CF-5	96	33.3		
CT-33	13	4.5		
CF/FA-18	25	8.7		
CT-114	70	24.3		
F-16	50	17.4		
UH-1	34	11.8		
Total			65,088	

Table J-3. Day/Night Split of Aircraft Operations for Proposed Action and Alternatives

Aircraft Type	Percent Daytime	Percent Nighttime
Proposed Action		
Air Cargo	50	50
Aircraft Maintenance	100	0
Air Carrier	97	3
General Aviation	93	7
Military	100	0
International Wayport Alternative		
Air Cargo	70	30
Air Carrier (International)	100	0
Maintenance	100	0
Air Carrier (Regional)	91	9
General Aviation	93	7
Military	100	0
Commercial Aviation Alternative		
Air Carrier	97	3
General Aviation	90	10

Note: Percentages are approximate for each category. Different aircraft within each category may have different day-night splits. For actual number of operations of each aircraft for each time period, refer to Table J-6. Daytime operations are assumed to occur between the hours of 7:00 a.m. and 7:00 p.m. Evening hours are assumed to occur between the hours of 7:00 p.m and 7:00 a.m.

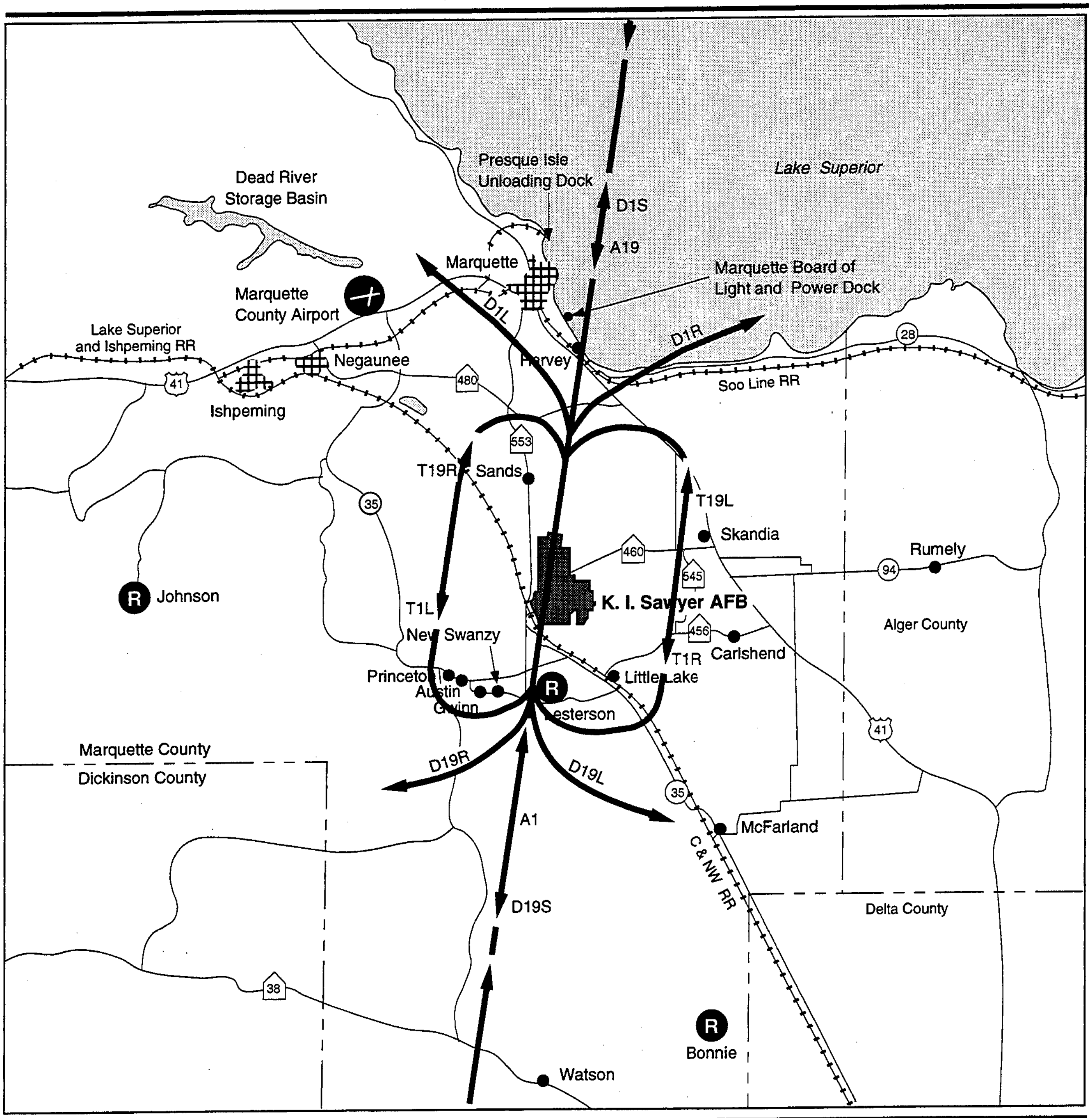
Table J-4. Stage Lengths Assumed for Aircraft Operations for the Proposed Action and Alternatives

Group	2000	2005	2015
Proposed Action			
Air Carrier	1	1	1
Air Cargo			
747-400		4	4
MD-11		4	4
757		2	2
Aircraft Maintenance	1	1	1
General Aviation	1	1	1
Military	2	2	2
International Wayport Alternative			
Air Cargo			
747-400		4	4
MD-11		4	4
757		2	2
Air Carrier (International)			
747-400		4	4
MD-11		4	4
757		2	2
Maintenance			
747-400		4	4
MD-11		4	4
757		2	2
Air Carrier (Regional)			
B-737-400		2	2
S-2000		1	1
Metro4		1	1
General Aviation	1	1	1
Military	2	2	2
Commercial Aviation Alternative			
Air Carrier	1	1	1
General Aviation	1	1	1

Note: Stage length may affect operational parameters such as takeoff or landing profiles, engine thrust settings, and aircraft speed of some aircraft; these parameters may in turn affect aircraft noise exposure. Stage lengths correspond to the distance flown in increments of 500 miles (e.g., stage length 1 corresponds to flights between 1 and 500 miles; 2 corresponds to flights between 500 and 1,000 miles, etc.). The maximum stage length used in modeling is 7 (>4,500 miles).

Table J-5. Number of Daily Runup Operations for the Proposed Action and Alternatives

Alternative	2000	2005	2015
Proposed Action			
Beech 1900	0.07	0.07	0.03
ATR-42	0.07	0.07	0.1
ATR-72	0	0.03	0.07
International Wayport Alternative			
747-400	0.08	0.17	0.26
MD-11	0.08	0.17	0.26
757	0.17	0.34	0.51
Commercial Aviation Alternative	0	0	0



EXPLANATION

Flight Paths		Restricted/Private Use Airport	
41	U.S. Highway		Public Use Airport
35	State Highway		County Line
38	County Road	C & NW	Chicago and Northwestern

0 2 4 8 Miles

Civilian Flight Tracks-Proposed Action and Commercial Aviation Alternative

Figure J-1

Table J-6a. Assignment of Operations for the Proposed Action (2000)
Page 1 of 2

	D1L		D1S		D1R		D19L		D19S		D19R	
Aircraft	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night
Beech1900	0.02	-	0.02	-	0.02	-	0.01	-	0.01	-	0.01	-
ATR-42	0.02	-	0.02	-	0.02	-	0.01	-	0.01	-	0.01	-
ATR-72	-	-	-	-	-	-	-	-	-	-	-	-
757	0.16	0.32	0.16	0.32	0.16	0.32	0.07	0.14	0.07	0.14	0.07	0.14
MD-11	0.16	0.16	0.16	0.16	0.16	0.16	0.07	0.07	0.07	0.07	0.07	0.07
747-400	0.16	-	0.16	-	0.16	-	0.07	-	0.07	-	0.07	-
Beech1900	0.82	-	0.82	-	0.82	-	0.35	-	0.35	-	0.35	-
Saab340	0.08	-	0.08	-	0.08	-	0.03	-	0.03	-	0.03	-
ATR-42	2.57	0.10	2.57	0.10	2.57	0.10	1.10	0.04	1.10	0.04	1.10	0.04
ATR-72	0.15	-	0.15	-	0.15	-	0.06	-	0.06	-	0.06	-
COMSEP	4.32	0.23	4.32	0.23	4.32	0.23	1.85	0.10	1.85	0.10	1.85	0.10
BEC58P	1.22	0.14	1.22	0.14	1.22	0.14	0.52	0.06	0.52	0.06	0.52	0.06
CNA442	0.27	0.05	0.27	0.05	0.27	0.05	0.12	0.02	0.12	0.02	0.12	0.02
G-IV	0.27	0.05	0.27	0.05	0.27	0.05	0.12	0.02	0.12	0.02	0.12	0.02
CF-5	0.03	-	0.03	-	0.03	-	0.01	-	0.01	-	0.01	-
CT-33	0.00	-	0.00	-	0.00	-	0.00	-	0.00	-	0.00	-
CF/FA-18	0.01	-	0.01	-	0.01	-	0.00	-	0.00	-	0.00	-
CT-114	0.02	-	0.02	-	0.02	-	0.01	-	0.01	-	0.01	-
F-16	0.02	-	0.02	-	0.02	-	0.01	-	0.01	-	0.01	-
UH-1	0.01	-	0.01	-	0.01	-	0.00	-	0.00	-	0.00	-

	A1		A19		T1L		T1R		T19L		T19R	
Aircraft	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night
Beech1900	0.05	-	0.02	-	-	-	-	-	-	-	-	-
ATR-42	0.05	-	0.02	-	-	-	-	-	-	-	-	-
ATR-72	-	-	-	-	-	-	-	-	-	-	-	-
757	0.48	0.96	0.20	0.41	0.36	-	-	-	-	-	-	0.31
MD-11	0.48	0.48	0.20	0.20	-	-	-	-	-	-	-	-
747-400	0.48	-	0.20	-	-	-	-	-	-	-	-	-
Beech1900	2.45	-	1.05	-	-	-	-	-	-	-	-	-
Saab340	0.23	-	0.10	-	-	-	-	-	-	-	-	-
ATR-42	7.71	0.30	3.30	0.13	5.78	-	-	-	-	-	-	-

Table J-6a. Assignment of Operations for the Proposed Action (2000)
Page 2 of 2

	A1		A19		T1L		T1R		T19L		T19R	
Aircraft	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night
ATR-72	0.44	-	0.19	-	0.33	-	0.11	-	0.05	-	0.14	-
G-IV	0.82	0.14	0.35	0.06	-	-	-	-	-	-	-	-
CF-5	0.09	-	0.04	-	-	-	-	-	-	-	-	-
CT-33	0.01	-	0.01	-	-	-	-	-	-	-	-	-
CF/FA-18	0.02	-	0.01	-	-	-	-	-	-	-	-	-
CT-114	0.07	-	0.03	-	-	-	-	-	-	-	-	-
F-16	0.05	-	0.02	-	-	-	-	-	-	-	-	-
UH-1	0.03	-	0.01	-	-	-	-	-	-	-	-	-
Beech1900	-	-	-	-	0.18	-	0.06	-	0.03	-	0.08	-
ATR-42	-	-	-	-	0.18	-	0.06	-	0.03	-	0.08	-
ATR-72	-	-	-	-	-	-	-	-	-	-	-	-
COMSEP	-	-	-	-	6.82	-	2.27	-	0.97	-	2.92	-
BEC58P	-	-	-	-	0.54	-	0.18	-	0.08	-	0.23	-

Table J-6b. Assignment of Operations for the Proposed Action (2005)
Page 1 of 2

	D1L		D1S		D1R		D19L		D19S		D19R	
Aircraft	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night
Beech1900	0.02	-	0.02	-	0.02	-	0.01	-	0.01	-	0.01	-
ATR-42	0.02	-	0.02	-	0.02	-	0.01	-	0.01	-	0.01	-
ATR-72	0.01	-	0.01	-	0.01	-	0.00	-	0.00	-	0.00	-
757	0.16	0.16	0.16	0.16	0.16	0.16	0.07	0.07	0.07	0.07	0.07	0.07
MD-11	0.16	0.16	0.16	0.16	0.16	0.16	0.07	0.07	0.07	0.07	0.07	0.07
747-400	0.32	-	0.32	-	0.32	-	0.14	-	0.14	-	0.14	-
Beech1900	0.83	-	0.83	-	0.83	-	0.36	-	0.36	-	0.36	-
Saab340	0.21	-	0.21	-	0.21	-	0.09	-	0.09	-	0.09	-
ATR-42	2.71	0.20	2.71	0.20	2.71	0.20	1.16	0.09	1.16	0.09	1.16	0.09
ATR-72	0.21	-	0.21	-	0.21	-	0.09	-	0.09	-	0.09	-
COMSEP	4.83	0.25	4.83	0.25	4.83	0.25	2.07	0.11	2.07	0.11	2.07	0.11
BEC58P	1.54	0.17	1.54	0.17	1.54	0.17	0.66	0.07	0.66	0.07	0.66	0.07
CNA442	0.36	0.06	0.36	0.06	0.36	0.06	0.15	0.03	0.15	0.03	0.15	0.03
G-IV	0.27	0.05	0.27	0.05	0.27	0.05	0.12	0.02	0.12	0.02	0.12	0.02
CF-5	0.03	-	0.03	-	0.03	-	0.01	-	0.01	-	0.01	-
CT-33	0.00	-	0.00	-	0.00	-	0.00	-	0.00	-	0.00	-
CF/FA-18	0.01	-	0.01	-	0.01	-	0.00	-	0.00	-	0.00	-
CT-114	0.02	-	0.02	-	0.02	-	0.01	-	0.01	-	0.01	-
F-16	0.02	-	0.02	-	0.02	-	0.01	-	0.01	-	0.01	-
UH-1	0.01	-	0.01	-	0.01	-	0.00	-	0.00	-	0.00	-

	A1		A19		T1L		T1R		T19L		T19R	
Aircraft	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night
Beech1900	0.05	-	0.02	-	-	-	-	-	-	-	-	-
ATR-42	0.05	-	0.02	-	-	-	-	-	-	-	-	-
ATR-72	0.02	-	0.01	-	-	-	-	-	-	-	-	-
757	0.48	0.48	0.21	0.21	0.36	-	-	-	-	-	-	0.15
MD-11	0.48	0.48	0.21	0.21	-	-	-	-	-	-	-	-

Table J-6b. Assignment of Operations for the Proposed Action (2005)
Page 2 of 2

	A1		A19		T1L		T1R		T19L		T19R	
Aircraft	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night
747-400	0.96	-	0.41	-	-	-	-	-	-	-	-	-
Beech1900	2.49	-	1.07	-	-	-	-	-	-	-	-	-
Saab340	0.63	-	0.27	-	-	-	-	-	-	-	-	-
ATR-42	8.13	0.60	3.48	0.26	6.10	-	-	-	-	-	-	-
ATR-72	0.63	-	0.27	-	0.47	-	0.16	-	0.07	-	0.20	-
COMSEP	14.48	0.76	6.20	0.33	-	-	-	-	-	-	-	-
BEC58P	4.62	0.52	1.98	0.22	-	-	-	-	-	-	-	-
CNA442	1.07	0.19	0.46	0.08	-	-	-	-	-	-	-	-
G-IV	0.82	0.14	0.35	0.06	-	-	-	-	-	-	-	-
CF-5	0.09	-	0.04	-	-	-	-	-	-	-	-	-
CT-33	0.01	-	0.01	-	-	-	-	-	-	-	-	-
CF/FA-18	0.02	-	0.01	-	-	-	-	-	-	-	-	-
CT-114	0.07	-	0.03	-	-	-	-	-	-	-	-	-
F-16	0.05	-	0.02	-	-	-	-	-	-	-	-	-
UH-1	0.03	-	0.01	-	-	-	-	-	-	-	-	-
Beech1900	-	-	-	-	0.18	-	0.06	-	0.03	-	0.08	-
ATR-42	-	-	-	-	0.18	-	0.06	-	0.03	-	0.08	-
ATR-72	-	-	-	-	0.09	-	0.03	-	0.01	-	0.04	-
COMSEP	-	-	-	-	7.62	-	2.54	-	1.09	-	3.27	-
BEC58P	-	-	-	-	0.68	-	0.23	-	0.10	-	0.29	-

Table J-6c. Assignment of Operations for the Proposed Action (2015)
Page 1 of 2

	D1L		D1S		D1R		D19L		D19S		D19R	
Aircraft	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night
Beech1900	0.01	-	0.01	-	0.01	-	0.00	-	0.00	-	0.00	-
ATR-42	0.02	-	0.02	-	0.02	-	0.01	-	0.01	-	0.01	-
ATR-72	0.02	-	0.02	-	0.02	-	0.01	-	0.01	-	0.01	-
757	0.16	-	0.16	-	0.16	-	0.07	-	0.07	-	0.07	-
MD-11	0.16	0.16	0.16	0.16	0.16	0.16	0.07	0.07	0.07	0.07	0.07	0.07
747-400	0.32	0.16	0.32	0.16	0.32	0.16	0.14	0.07	0.14	0.07	0.14	0.07
Beech1900	0.74	-	0.74	-	0.74	-	0.32	-	0.32	-	0.32	-
Saab340	0.35	-	0.35	-	0.35	-	0.15	-	0.15	-	0.15	-
ATR-42	3.17	0.20	3.17	0.20	3.17	0.20	1.36	0.09	1.36	0.09	1.36	0.09
ATR-72	0.49	-	0.49	-	0.49	-	0.21	-	0.21	-	0.21	-
COMSEP	6.20	0.33	6.20	0.33	6.20	0.33	2.66	0.14	2.66	0.14	2.66	0.14
BEC58P	2.07	0.23	2.07	0.23	2.07	0.23	0.89	0.10	0.89	0.10	0.89	0.10
CNA442	0.46	0.08	0.46	0.08	0.46	0.08	0.20	0.03	0.20	0.03	0.20	0.03
G-IV	0.33	0.06	0.33	0.06	0.33	0.06	0.14	0.02	0.14	0.02	0.14	0.02
CF-5	0.03	-	0.03	-	0.03	-	0.01	-	0.01	-	0.01	-
CT-33	0.00	-	0.00	-	0.00	-	0.00	-	0.00	-	0.00	-
CF/FA-18	0.01	-	0.01	-	0.01	-	0.00	-	0.00	-	0.00	-
CT-114	0.02	-	0.02	-	0.02	-	0.01	-	0.01	-	0.01	-
F-16	0.02	-	0.02	-	0.02	-	0.01	-	0.01	-	0.01	-
UH-1	0.01	-	0.01	-	0.01	-	0.00	-	0.00	-	0.00	-

	A1		A19		T1L		T1R		T19L		T19R	
Aircraft	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night
Beech1900	0.02	-	0.01	-	-	-	-	-	-	-	-	-
ATR-42	0.07	-	0.03	-	-	-	-	-	-	-	-	-
ATR-72	0.05	-	0.02	-	-	-	-	-	-	-	-	-
757	0.48	-	0.21	-	0.36	-	-	-	-	-	-	-
MD-11	0.48	0.48	0.21	0.21	-	-	-	-	-	-	-	-

Table J-6c. Assignment of Operations for the Proposed Action (2015)
Page 2 of 2

	A1		A19		T1L		T1R		T19L		T19R	
Aircraft	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night
747-400	0.96	0.48	0.41	0.21	-	-	-	-	-	-	-	-
Beech1900	2.23	-	0.95	-	-	-	-	-	-	-	-	-
Saab340	1.04	-	0.45	-	-	-	-	-	-	-	-	-
ATR-42	9.52	0.60	4.08	0.26	7.14	-	-	-	-	-	-	-
ATR-72	1.48	-	0.64	-	1.11	-	0.37	-	0.16	-	0.48	-
COMSEP	18.59	0.98	7.97	0.42	-	-	-	-	-	-	-	-
BEC58P	6.22	0.69	2.67	0.30	-	-	-	-	-	-	-	-
CNA442	1.39	0.24	0.59	0.10	-	-	-	-	-	-	-	-
G-IV	0.98	0.17	0.42	0.07	-	-	-	-	-	-	-	-
CF-5	0.09	-	0.04	-	-	-	-	-	-	-	-	-
CT-33	0.01	-	0.01	-	-	-	-	-	-	-	-	-
CF/FA-18	0.02	-	0.01	-	-	-	-	-	-	-	-	-
CT-114	0.07	-	0.03	-	-	-	-	-	-	-	-	-
F-16	0.05	-	0.02	-	-	-	-	-	-	-	-	-
UH-1	0.03	-	0.01	-	-	-	-	-	-	-	-	-
Beech1900	-	-	-	-	0.09	-	0.03	-	0.01	-	0.04	-
ATR-42	-	-	-	-	0.27	-	0.09	-	0.04	-	0.12	-
ATR-72	-	-	-	-	0.18	-	0.06	-	0.03	-	0.08	-
COMSEP	-	-	-	-	9.78	-	3.26	-	1.40	-	4.19	-
BEC58P	-	-	-	-	0.92	-	0.31	-	0.13	-	0.39	-

A standard 3 degree glide slope and the takeoff profiles provided by the Federal Aviation Administration's (FAA) Integrated Noise Model (INM) Database 4.11 (Federal Aviation Administration, 1993) were assumed for all aircraft.

Surface traffic data used in the modeling were developed from the project traffic study presented in Section 4.2.3, Transportation, and are shown in Table J-7. The traffic mix, day/night split, and speed were assumed to remain the same as for the preclosure reference. Number of residents impacted was determined from aerial photographs dated November 9, 1991 and USGS maps dated photorevised 1975 and provisional 1985.

1.4 INTERNATIONAL WAYPORT ALTERNATIVE

Under the International Wayport Alternative, as in the Proposed Action, the base airfield would be converted to civilian use. The primary components of the aviation action include air passenger, maintenance, air cargo, and general aviation operations.

The airport layout would change under this alternative. A crosswind runway would be constructed after the year 2005.

The fleet mix and annual operations for each of the modeled years are contained in Table J-8. The DNL contours for the proposed flight operations are presented in Section 4.4.4, Noise. The proposed flight tracks modeled are slightly different from those for the Proposed Action due to the runway configuration change described above. The International Wayport flight tracks are shown in Figure J-2. The day/night split for all aircraft operations are given in Table J-3. Stage lengths for air operations are given in Table J-4.

Engine runup operations were assumed to occur at the same location as in the Proposed Action as described in Section 4.4.4, Noise. The number of runup operations is given in Table J-5. During typical runup operations, the engines would run for 20 minutes at idle power and 5 minutes at departure power. It was assumed that no noise suppression facilities would be available. The aircraft were assumed to have a heading of 20 degrees.

General aviation operations would be divided into the same general categories as in the Proposed Action. It was assumed that 41 percent of the single-engine piston and 16 percent of the multi-engine piston general aviation operations would be touch-and-go (or closed loop) activities.

A standard 3 degree glide slope and the takeoff profiles provided by the FAA's INM Database 4.11 were assumed for all aircraft. Daily operations assigned to each flight track and the time period for the International Wayport Alternative are provided in Table J-9.

Table J-7a. Surface Traffic Operations for Total Volumes (Project and Non-Project)

Alternative	Roadway	Segment	Annual Average Daily Traffic (AADT) 2000	2005	2015
Proposed Action	CR 462	Main Gate to CR 553	4,300	8,150	15,500
	CR 460	Gate 2 to CR 545	2,600	4,750	9,450
	CR 460	CR 545 to U.S. 41	2,600	3,850	6,900
	CR 480	West of CR 553	5,400	7,200	11,250
	CR 480	CR 553 to U.S. 41	3,600	4,500	6,750
	CR 553	Marquette city limits to CR 480	8,100	10,800	18,000
	CR 553	CR 480 to CR 462	9,450	14,400	24,300
	CR 553	CR 462 to Southgate Drive	9,450	14,400	24,300
	CR 553	Southgate Drive to SH 35	5,400	7,650	11,700
	CR 545	U.S. 41 to CR 460	1,800	2,700	4,950
	CR 545	CR 460 to CR 456	900	1,350	2,700
	CR 456	SH 35 to CR 545	3,150	4,050	6,750
	CR 456	CR 545 to U.S. 41	1,350	2,250	3,600
	U.S. 41	SH 28 to Skandia	8,050	10,050	15,250
	U.S. 41	Skandia to SH 94	5,200	6,850	10,450
	U.S. 41	SH 94 to CR 456	2,800	3,600	5,200
	SH 35	CR 553 to CR 456	4,050	6,300	10,600
	SH 35	CR 456 to Morbit Lake Access	900	1,350	2,250
International Wayport Alternative	CR 462	Main Gate to CR 553	8,200	11,600	17,650
	CR 460	Gate 2 to CR 545	3,450	4,300	6,900
	CR 460	CR 545 to U.S. 41	3,000	3,900	5,600
	CR 480	West of CR 553	5,850	7,200	10,350
	CR 480	CR 553 to U.S. 41	3,600	4,500	6,750
	CR 553	Marquette city limits to CR 480	8,550	10,800	16,200
	CR 553	CR 480 to CR 462	10,350	13,950	21,150
	CR 553	CR 462 to Southgate Drive	10,350	13,500	20,700
	CR 553	Southgate Drive to SH 35	5,850	7,200	10,800
	CR 545	U.S. 41 to CR 460	2,250	2,700	4,050
	CR 545	CR 460 to CR 456	900	1,350	2,250
	CR 456	SH 35 to CR 545	3,150	4,050	5,850
	CR 456	CR 545 to U.S. 41	1,800	1,800	3,150
	U.S. 41	SH 28 to Skandia	8,000	10,050	14,850
	U.S. 41	Skandia to SH 94	5,600	6,800	10,050
	U.S. 41	SH 94 to CR 456	2,800	3,600	5,200
	SH 35	CR 553 to CR 456	4,500	6,300	9,000
	SH 35	CR 456 to Morbit Lake Access	900	1,350	2,250

CR = County Road
SH = State Highway
U.S.# = U.S. Highway

Table J-7b. Surface Traffic Operations for Total Volumes (Project and Non-Project)

Alternative	Roadway	Segment	Annual Average Daily Traffic (AADT) 2000	2005	2015
Commercial Aviation Alternative	CR 462	Main Gate to CR 553	5,150	8,600	14,200
	CR 460	Gate 2 to CR 545	1,700	3,000	4,750
	CR 460	CR 545 to U.S. 41	2,150	3,000	4,750
	CR 480	West of CR 553	5,400	6,750	9,900
	CR 480	CR 553 to U.S. 41	3,600	4,500	6,300
	CR 553	Marquette city limits to CR 480	7,200	9,500	14,400
	CR 553	CR 480 to CR 462	8,100	11,250	17,550
	CR 553	CR 462 to Southgate Drive	8,100	10,800	17,100
	CR 553	Southgate Drive to SH 35	5,000	6,300	9,450
	CR 545	U.S. 41 to CR 460	1,350	2,250	3,150
	CR 545	CR 460 to CR 456	450	900	1,350
	CR 456	SH 35 to CR 545	2,700	3,800	5,400
	CR 456	CR 545 to U.S. 41	900	1,350	2,250
	U.S. 41	SH 28 to Skandia	8,050	9,650	14,450
	U.S. 41	Skandia to SH 94	5,200	6,400	9,650
	U.S. 41	SH 94 to CR 456	2,800	3,600	5,200
	SH 35	CR 553 to CR 456	3,150	4,500	7,200
	SH 35	CR 456 to Morbit Lake Access	900	1,350	1,800
Recreation Alternative	CR 462	Main Gate to CR 553	1,570	2,220	3,530
	CR 460	Gate 2 to CR 545	470	570	1,080
	CR 460	CR 545 to U.S. 41	1,880	2,310	3,450
	CR 480	West of CR 553	4,840	5,920	8,790
	CR 480	CR 553 to U.S. 41	3,430	4,180	6,200
	CR 553	Marquette city limits to CR 480	6,370	7,830	11,650
	CR 553	CR 480 to CR 462	6,420	7,970	11,920
	CR 553	CR 462 to Southgate Drive	6,050	7,530	11,280
	CR 553	Southgate Drive to SH 35	4,110	5,050	7,530
	CR 545	U.S. 41 to CR 460	1,140	1,420	2,140
	CR 545	CR 460 to CR 456	250	330	510
	CR 456	SH 35 to CR 545	2,330	2,860	4,260
	CR 456	CR 545 to U.S. 41	680	860	1,300
	U.S. 41	SH 28 to Skandia	7,610	9,280	13,750
	U.S. 41	Skandia to SH 94	4,970	6,070	9,000
	U.S. 41	SH 94 to CR 456	2,750	3,350	4,970
	SH 35	CR 553 to CR 456	2,430	3,040	4,660
	SH 35	CR 456 to Morbit Lake Access	910	1,230	1,820

CR = County Road
SH = State Highway
U.S.# = U.S. Highway

Table J-7c. Surface Traffic Operations for Total Volumes (Project and Non-Project)

Alternative	Roadway	Segment	Annual Average Daily Traffic (AADT) 2000	2005	2015
No-Action	CR 462	Main Gate to CR 553	128	152	224
Alternative	CR 460	Gate 2 to CR 545	32	38	56
	CR 460	CR 545 to U.S. 41	1,670	2,040	3,010
	CR 480	West of CR 553	4,700	5,720	8,470
	CR 480	CR 553 to U.S. 41	3,390	4,130	6,110
	CR 553	Marquette city limits to CR 480	6,020	7,320	10,640
	CR 553	CR 480 to CR 462	5,690	6,920	10,250
	CR 553	CR 462 to Southgate Drive	5,310	6,460	9,560
	CR 553	Southgate Drive to SH 35	3,830	4,680	6,900
	CR 545	U.S. 41 to CR 460	980	1,200	1,770
	CR 545	CR 460 to CR 456	110	130	200
	CR 456	SH 35 to CR 545	2,190	2,660	3,940
	CR 456	CR 545 to U.S. 41	550	670	990
	U.S. 41	SH 28 to Skandia	7,520	9,150	13,540
	U.S. 41	Skandia to SH 94	4,880	5,940	8,790
	U.S. 41	SH 94 to CR 456	2,730	3,330	4,930
	SH 35	CR 553 to CR 456	2,080	2,530	3,740
	SH 35	CR 456 to Morbit Lake Access	890	1,200	1,770

CR = County Road
SH = State Highway
U.S.# = U.S. Highway

Table J-8a. Annual Operations for the International Wayport Alternative (2000)

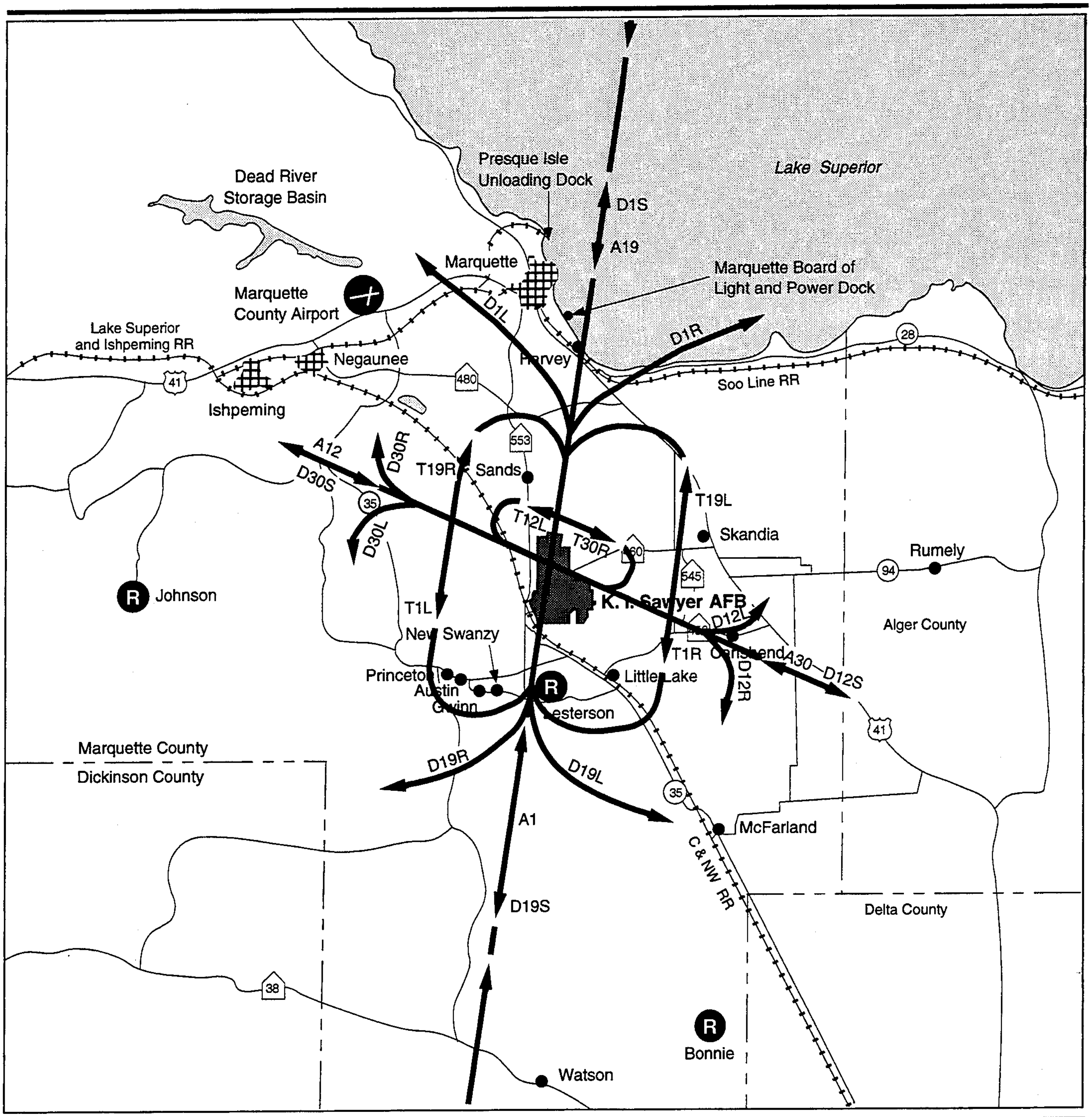
Type of Aircraft	Number of Operations	Percent of Category	Total for Category	Category Percent of Total
Air Cargo			3,000	6.7
747-400	600	20		
MD-11	1,200	40		
757	1,200	40		
Air Carrier (International)			6,500	14.4
747-400	2,000	30.8		
MD-11	500	7.7		
757	4,000	61.5		
Maintenance			1,000	2.2
747-400	250	25		
MD-11	250	25		
757	500	50		
Air Carrier (Regional)			3,512	7.8
737-400	2,000	56.9		
S-2000	1,512	43.1		
Metro3, 4	0	0		
General Aviation			30,700	68.2
Single Engine	23,700	77.2		
Multi-engine	5,000	16.3		
Turboprop	1,000	3.3		
Turbojet	1,000	3.3		
Military			288	0.6
CF-5	96	33.3		
CT-30	13	4.5		
CF/FA-18	25	8.7		
CT-114	70	24.3		
F-16	50	17.4		
UH-1	34	11.8		
Total			45,000	

Table J-8b. Annual Operations for the International Wayport Alternative (2005)

Type of Aircraft	Number of Operations	Percent of Category	Total for Category	Category Percent of Total
Air Cargo			9,500	13.1
747-400	1,900	20		
MD-11	3,800	40		
757	3,800	40		
Air Carrier (International)			10,612	14.6
747-400	3,130	29.5		
MD-11	1,222	11.5		
757	6,260	59		
Maintenance			2,000	2.8
747-400	500	25		
MD-11	500	25		
757	1,000	50		
Air Carrier (Regional)			15,000	20.7
737-400	3,000	20		
S-2000	6,000	40		
Metro3, 4	6,000	40		
General Aviation			35,100	48.4
Single Engine	26,500	75.5		
Multi-engine	6,300	17.9		
Turboprop	1,300	3.7		
Turbojet	1,000	2.8		
Military			288	0.4
CF-5	96	33.3		
CT-30	13	4.5		
CF/FA-18	25	8.7		
CT-114	70	24.3		
F-16	50	17.4		
UH-1	34	11.8		
Total			72,500	

Table J-8c. Annual Operations for the International Wayport Alternative (2015)

Type of Aircraft	Number of Operations	Percent of Category	Total for Category	Category Percent of Total
Air Cargo			13,000	13
747-400	2,600	20		
MD-11	5,200	40		
757	5,200	40		
Air Carrier (International)			16,000	16
747-400	4,800	30		
MD-11	1,600	10		
757	9,600	60		
Maintenance			3,000	3
747-400	750	25		
MD-11	750	25		
757	1,500	50		
Air Carrier (Regional)			22,312	22.3
737-400	5,000	22.4		
S-2000	8,656	38.8		
Metro3, 4	8,656	38.8		
General Aviation			45,400	45.4
Single Engine	34,000	74.9		
Multi-engine	8,500	18.7		
Turboprop	1,700	3.7		
Turbojet	1,200	2.6		
Military			288	0.3
CF-5	96	33.3		
CT-30	13	4.5		
CF/FA-18	25	8.7		
CT-114	70	24.3		
F-16	50	17.4		
UH-1	34	11.8		
Total			100,000	



EXPLANATION

Flight Paths

U.S. Highway

State Highway

County Road

Restricted/Private Use Airport

Public Use Airport

County Line

C & NW — Chicago and Northwestern

0 2 4 8 Miles

Civilian Flight Tracks-International Wayport Alternative

Figure J-2

Table J-9a. Assignment of Operations for the International Wayport Alternative (2000)
Page 1 of 2

	D1L		D1S		D1R		D19L		D19S		D19R	
Aircraft	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night
747-400	0.02	-	0.02	-	0.02	-	0.01	-	0.01	-	0.01	-
MD-11	0.02	-	0.02	-	0.02	-	0.01	-	0.01	-	0.01	-
757	0.04	-	0.04	-	0.04	-	0.02	-	0.02	-	0.02	-
747-400	0.19	-	0.19	-	0.19	-	0.08	-	0.08	-	0.08	-
MD-11	0.29	0.10	0.29	0.10	0.29	0.10	0.12	0.04	0.12	0.04	0.12	0.04
757	0.19	0.19	0.19	0.19	0.19	0.19	0.08	0.08	0.08	0.08	0.08	0.08
747-400	0.64	-	0.64	-	0.64	-	0.27	-	0.27	-	0.27	-
MD-11	0.16	-	0.16	-	0.16	-	0.07	-	0.07	-	0.07	-
757	1.28	-	1.28	-	1.28	-	0.55	-	0.55	-	0.55	-
737-400	0.61	0.03	0.61	0.03	0.61	0.03	0.26	0.01	0.26	0.01	0.26	0.01
Saab2000	0.41	0.07	0.41	0.07	0.41	0.07	0.18	0.03	0.18	0.03	0.18	0.03
MetroIV	-	-	-	-	-	-	-	-	-	-	-	-
COMSEP	5.40	0.38	5.40	0.38	5.40	0.38	2.31	0.16	2.31	0.16	2.31	0.16
BEC58P	1.45	0.08	1.45	0.08	1.45	0.08	0.62	0.03	0.62	0.03	0.62	0.03
CNA442	0.29	0.03	0.29	0.03	0.29	0.03	0.12	0.01	0.12	0.01	0.12	0.01
G-IV	0.29	0.03	0.29	0.03	0.29	0.03	0.12	0.01	0.12	0.01	0.12	0.01
CF-5	0.03	-	0.03	-	0.03	-	0.01	-	0.01	-	0.01	-
CT-33	0.00	-	0.00	-	0.00	-	0.00	-	0.00	-	0.00	-
CF/FA-18	0.01	-	0.01	-	0.01	-	0.00	-	0.00	-	0.00	-
CT-114	0.02	-	0.02	-	0.02	-	0.01	-	0.01	-	0.01	-
F-16	0.02	-	0.02	-	0.02	-	0.01	-	0.01	-	0.01	-
UH-1	0.01	-	0.01	-	0.01	-	0.00	-	0.00	-	0.00	-

	T1L		T1R		T19L		T19R		A1		A19	
Aircraft	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night
747-400	-	-	-	-	-	-	-	-	0.06	-	0.03	-
MD-11	-	-	-	-	-	-	-	-	0.06	-	0.03	-
757	-	-	-	-	-	-	-	-	0.12	-	0.05	-
747-400	-	-	-	-	-	-	-	-	0.58	-	0.25	-
MD-11	-	-	-	-	-	-	-	-	0.86	0.29	0.37	0.12

Table J-9a. Assignment of Operations for the International Wayport Alternative (2000)
Page 2 of 2

	T1L		T1R		T19L		T19R		A1		A19	
Aircraft	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night
757	-	-	-	-	-	-	-	-	0.58	0.57	0.25	0.25
747-400	-	-	-	-	-	-	-	-	1.92	-	0.82	-
MD-11	-	-	-	-	-	-	-	-	0.48	-	0.21	-
757	-	-	-	-	-	-	-	-	3.83	-	1.64	-
737-400	-	-	-	-	-	-	-	-	1.82	0.10	0.78	0.04
Saab2000	-	-	-	-	-	-	-	-	1.24	0.21	0.53	0.09
MetroIV	-	-	-	-	-	-	-	-	-	-	-	-
COMSEP	-	-	-	-	-	-	-	-	16.19	1.14	6.94	0.49
BEC58P	-	-	-	-	-	-	-	-	4.34	0.24	1.86	0.10
CNA442	-	-	-	-	-	-	-	-	0.87	0.10	0.37	0.04
G-IV	-	-	-	-	-	-	-	-	0.87	0.10	0.37	0.04
CF-5	-	-	-	-	-	-	-	-	0.09	-	0.04	-
CT-33	-	-	-	-	-	-	-	-	0.01	-	0.01	-
CF/FA-18	-	-	-	-	-	-	-	-	0.02	-	0.01	-
CT-114	-	-	-	-	-	-	-	-	0.07	-	0.03	-
F-16	-	-	-	-	-	-	-	-	0.05	-	0.02	-
UH-1	-	-	-	-	-	-	-	-	0.03	-	0.01	-
747-400	0.13	-	0.04	-	0.02	-	0.06	-	-	-	-	-
MD-11	0.13	-	0.04	-	0.02	-	0.06	-	-	-	-	-
757	0.27	-	0.09	-	0.04	-	0.12	-	-	-	-	-
COMSEP	4.05	-	1.35	-	0.58	-	1.74	-	-	-	-	-
BEC58P	0.17	-	0.06	-	0.02	-	0.07	-	-	-	-	-

Table J-9b. Assignment of Operations for the International Wayport Alternative (2005)

Page 1 of 2

	D1L		D1S		D1R		D19L		D19S		D19R	
Aircraft	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night
747-400	0.04	-	0.04	-	0.04	-	0.02	-	0.02	-	0.02	-
MD-11	0.04	-	0.04	-	0.04	-	0.02	-	0.02	-	0.02	-
757	0.08	-	0.08	-	0.08	-	0.03	-	0.03	-	0.03	-
747-400	0.55	0.06	0.55	0.06	0.55	0.06	0.23	0.02	0.23	0.01	0.23	0.00
MD-11	0.91	0.30	0.91	0.30	0.91	0.30	0.39	0.13	0.39	0.13	0.39	0.13
757	0.61	0.61	0.61	0.61	0.61	0.61	0.26	0.26	0.26	0.26	0.26	0.26
747-400	1.00	-	1.00	-	1.00	-	0.43	-	0.43	-	0.43	-
MD-11	0.39	-	0.39	-	0.39	-	0.17	-	0.17	-	0.17	-
757	2.00	-	2.00	-	2.00	-	0.86	-	0.86	-	0.86	-
737-400	0.91	0.05	0.91	0.05	0.91	0.05	0.39	0.02	0.39	0.02	0.39	0.02
Saab2000	1.65	0.27	1.65	0.27	1.65	0.27	0.71	0.12	0.71	0.12	0.71	0.12
MetroIV	1.65	0.27	1.65	0.27	1.65	0.27	0.71	0.12	0.71	0.12	0.71	0.12
COMSEP	6.04	0.42	6.04	0.42	6.04	0.42	2.59	0.18	2.59	0.18	2.59	0.18
BEC58P	1.81	0.10	1.81	0.10	1.81	0.10	0.78	0.04	0.78	0.04	0.78	0.04
CNA442	0.37	0.04	0.37	0.04	0.37	0.04	0.16	0.02	0.16	0.02	0.16	0.02
G-IV	0.29	0.03	0.29	0.03	0.29	0.03	0.12	0.01	0.12	0.01	0.12	0.01
CF-5	0.03	-	0.03	-	0.03	-	0.01	-	0.01	-	0.01	-
CT-33	0.00	-	0.00	-	0.00	-	0.00	-	0.00	-	0.00	-
CF/FA-18	0.01	-	0.01	-	0.01	-	0.00	-	0.00	-	0.00	-
CT-114	0.02	-	0.02	-	0.02	-	0.01	-	0.01	-	0.01	-
F-16	0.02	-	0.02	-	0.02	-	0.01	-	0.01	-	0.01	-
UH-1	0.01	-	0.01	-	0.01	-	0.00	-	0.00	-	0.00	-

	T1L		T1R		T19L		T19R		A1		A19	
Aircraft	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night
747-400	-	-	-	-	-	-	-	-	0.12	-	0.05	-
MD-11	-	-	-	-	-	-	-	-	0.12	-	0.05	-
757	-	-	-	-	-	-	-	-	0.24	-	0.10	-
747-400	-	-	-	-	-	-	-	-	1.64	-	0.70	-
MD-11	-	-	-	-	-	-	-	-	2.73	0.91	1.17	0.39
757	-	-	-	-	-	-	-	-	1.82	1.82	0.78	0.78
747-400	-	-	-	-	-	-	-	-	3.00	-	1.29	-
MD-11	-	-	-	-	-	-	-	-	1.17	-	0.50	-
757	-	-	-	-	-	-	-	-	6.01	-	2.57	-

Table J-9b. Assignment of Operations for the International Wayport Alternative (2005)
Page 2 of 2

	T1L		T1R		T19L		T19R		A1		A19	
Aircraft	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night
737-400	-	-	-	-	-	-	-	-	2.73	0.14	1.17	0.06
Saab2000	-	-	-	-	-	-	-	-	4.94	0.82	2.12	0.35
MetroIV	-	-	-	-	-	-	-	-	4.94	0.82	2.12	0.35
COMSEP	-	-	-	-	-	-	-	-	18.11	1.27	7.76	0.54
BEC58P	-	-	-	-	-	-	-	-	5.44	0.30	2.33	0.13
CNA442	-	-	-	-	-	-	-	-	1.12	0.13	0.48	0.05
G-IV	-	-	-	-	-	-	-	-	0.87	0.10	0.37	0.04
CF-5	-	-	-	-	-	-	-	-	0.09	-	0.04	-
CT-33	-	-	-	-	-	-	-	-	0.01	-	0.01	-
CF/FA-18	-	-	-	-	-	-	-	-	0.02	-	0.01	-
CT-114	-	-	-	-	-	-	-	-	0.07	-	0.03	-
F-16	-	-	-	-	-	-	-	-	0.05	-	0.02	-
UH-1	-	-	-	-	-	-	-	-	0.03	-	0.01	-
747-400	0.27	-	0.09	-	0.04	-	0.12	-	-	-	-	-
MD-11	0.27	-	0.09	-	0.04	-	0.12	-	-	-	-	-
757	0.54	-	0.18	-	0.08	-	0.23	-	-	-	-	-
COMSEP	4.53	-	1.51	-	0.65	-	1.94	-	-	-	-	-
BEC58P	0.21	-	0.07	-	0.03	-	0.09	-	-	-	-	-

Table J-9c. Assignment of Operations for the International Wayport Alternative (2015)
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	D1L		D1S		D1R		D12L		D12S		D12R		D19L		D19S		D19R		D30L		D30S		D30R	
Aircraft	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night
747-400	0.06	-	0.06	-	0.06	-	-	-	-	-	-	-	0.03	-	0.03	-	0.03	-	-	-	-	-	-	-
MD-11	0.06	-	0.06	-	0.06	-	-	-	-	-	-	-	0.03	-	0.03	-	0.03	-	-	-	-	-	-	-
757	0.12	-	0.12	-	0.12	-	-	-	-	-	-	-	0.05	-	0.05	-	0.05	-	-	-	-	-	-	-
747-400	0.66	0.17	0.66	0.17	0.66	0.17	-	-	-	-	-	-	0.28	0.07	0.28	0.07	0.28	0.07	-	-	-	-	-	-
MD-11	1.25	0.41	1.25	0.41	1.25	0.41	-	-	-	-	-	-	0.53	0.18	0.53	0.18	0.53	0.18	-	-	-	-	-	-
757	0.83	0.83	0.83	0.83	0.83	0.83	-	-	-	-	-	-	0.35	0.35	0.35	0.35	0.35	0.35	-	-	-	-	-	-
747-400	1.53	-	1.53	-	1.53	-	-	-	-	-	-	-	0.65	-	0.65	-	0.65	-	-	-	-	-	-	-
MD-11	0.51	-	0.51	-	0.51	-	-	-	-	-	-	-	0.22	-	0.22	-	0.22	-	-	-	-	-	-	-
757	3.07	-	3.07	-	3.07	-	-	-	-	-	-	-	1.30	-	1.30	-	1.30	-	-	-	-	-	-	-
737-400	1.51	0.08	1.51	0.08	1.51	0.08	-	-	-	-	-	-	0.64	0.03	0.64	0.03	0.64	0.03	-	-	-	-	-	-
Saab2000	2.37	0.39	2.37	0.39	2.37	0.39	-	-	-	-	-	-	1.01	0.17	1.01	0.17	1.01	0.17	-	-	-	-	-	-
MetroIV	2.37	0.39	2.37	0.39	2.37	0.39	-	-	-	-	-	-	1.01	0.17	1.01	0.17	1.01	0.17	-	-	-	-	-	-
COMSEP	6.96	0.54	6.96	0.54	6.96	0.54	0.77	-	0.77	-	0.77	-	2.98	0.23	2.98	0.23	2.98	0.23	0.33	-	0.33	-	0.33	-
BEC58P	2.20	0.14	2.20	0.14	2.20	0.14	0.24	-	0.24	-	0.24	-	0.94	0.06	0.94	0.06	0.94	0.06	0.10	-	0.10	-	0.10	-
CNA442	0.44	0.05	0.44	0.05	0.44	0.05	0.05	-	0.05	-	0.05	-	0.19	0.02	0.19	0.02	0.19	0.02	0.02	-	0.02	-	0.02	-
G-IV	0.31	0.04	0.31	0.04	0.31	0.04	0.03	-	0.03	-	0.03	-	0.13	0.02	0.13	0.02	0.13	0.02	0.01	-	0.01	-	0.01	-
CF-5	0.03	-	0.03	-	0.03	-	-	-	-	-	-	-	0.01	-	0.01	-	0.01	-	-	-	-	-	-	-
CT-33	0.00	-	0.00	-	0.00	-	-	-	-	-	-	-	0.00	-	0.00	-	0.00	-	-	-	-	-	-	-
CF/FA-18	0.01	-	0.01	-	0.01	-	-	-	-	-	-	-	0.00	-	0.00	-	0.00	-	-	-	-	-	-	-
CT-114	0.02	-	0.02	-	0.02	-	-	-	-	-	-	-	0.01	-	0.01	-	0.01	-	-	-	-	-	-	-
F-16	0.02	-	0.02	-	0.02	-	-	-	-	-	-	-	0.01	-	0.01	-	0.01	-	-	-	-	-	-	-
UH-1	0.01	-	0.01	-	0.01	-	-	-	-	-	-	-	0.00	-	0.00	-	0.00	-	-	-	-	-	-	-

Table J-9c. Assignment of Operations for the International Wayport Alternative (2015)
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	T1L		T1R		T19L		T19R		T30R		T12L		A1		A12		A19		A30	
Aircraft	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night
747-400	-	-	-	-	-	-	-	-	-	-	-	-	0.18	-	-	-	0.08	-	-	-
MD-11	-	-	-	-	-	-	-	-	-	-	-	-	0.18	-	-	-	0.08	-	-	-
757	-	-	-	-	-	-	-	-	-	-	-	-	0.36	-	-	-	0.15	-	-	-
747-400	-	-	-	-	-	-	-	-	-	-	-	-	1.99	0.50	-	-	0.85	0.21	-	-
MD-11	-	-	-	-	-	-	-	-	-	-	-	-	3.74	1.25	-	-	1.60	0.53	-	-
757	-	-	-	-	-	-	-	-	-	-	-	-	2.49	2.49	-	-	1.07	1.07	-	-
747-400	-	-	-	-	-	-	-	-	-	-	-	-	4.60	-	-	-	1.97	-	-	-
MD-11	-	-	-	-	-	-	-	-	-	-	-	-	1.53	-	-	-	0.66	-	-	-
757	-	-	-	-	-	-	-	-	-	-	-	-	9.21	-	-	-	3.95	-	-	-
737-400	-	-	-	-	-	-	-	-	-	-	-	-	4.55	0.24	-	-	1.95	0.10	-	-
Saab2000	-	-	-	-	-	-	-	-	-	-	-	-	7.12	1.19	-	-	3.05	0.51	-	-
MetroIV	-	-	-	-	-	-	-	-	-	-	-	-	7.12	1.19	-	-	3.05	0.51	-	-
COMSEP	-	-	-	-	-	-	-	-	-	-	-	-	20.90	1.63	2.32	-	8.96	0.70	1.00	-
BEC58P	-	-	-	-	-	-	-	-	-	-	-	-	6.61	0.41	0.73	-	2.83	0.17	0.31	-
CNA442	-	-	-	-	-	-	-	-	-	-	-	-	1.31	0.16	0.15	-	0.56	0.07	0.06	-
G-IV	-	-	-	-	-	-	-	-	-	-	-	-	0.92	0.12	0.10	-	0.40	0.05	0.04	-
CF-5	-	-	-	-	-	-	-	-	-	-	-	-	0.09	-	-	-	0.04	-	-	-
CT-33	-	-	-	-	-	-	-	-	-	-	-	-	0.01	-	-	-	0.01	-	-	-
CF/FA-18	-	-	-	-	-	-	-	-	-	-	-	-	0.02	-	-	-	0.01	-	-	-
CT-114	-	-	-	-	-	-	-	-	-	-	-	-	0.07	-	-	-	0.03	-	-	-
F-16	-	-	-	-	-	-	-	-	-	-	-	-	0.05	-	-	-	0.02	-	-	-
UH-1	-	-	-	-	-	-	-	-	-	-	-	-	0.03	-	-	-	0.01	-	-	-
747-400	0.40	-	0.13	-	0.06	-	0.17	-	-	-	-	-	-	-	-	-	-	-	-	-
MD-11	0.40	-	0.13	-	0.06	-	0.17	-	-	-	-	-	-	-	-	-	-	-	-	-
757	0.81	-	0.27	-	0.12	-	0.35	-	-	-	-	-	-	-	-	-	-	-	-	-
COMSEP	6.97	-	-	-	-	-	0.33	-	0.77	-	2.99	-	-	-	-	-	-	-	-	-
BEC58P	0.35	-	-	-	-	-	0.02	-	0.04	-	0.15	-	-	-	-	-	-	-	-	-

Surface traffic data used in the modeling were developed from the project traffic study and are shown in Table J-7. The traffic mix, day/night split, and speed were assumed to remain the same as for the preclosure reference. Number of residents impacted was determined from the same sources as described under the Proposed Action.

1.5 COMMERCIAL AVIATION ALTERNATIVE

The Commercial Aviation Alternative for the reuse of K. I. Sawyer AFB would be centered on a regional commercial airport. As in the Proposed Action, the airfield would be converted to civilian use. Primary components of the aviation action include general aviation operations and commercial passenger operations.

The fleet mix and annual operations for each of the modeled years are contained in Table J-10. The DNL contours for the proposed flight operations and mining operations are presented in Section 4.4.4, Noise. The proposed flight tracks modeled are similar to those for the Proposed Action and are presented in Section 4.4.4. The day-night split for all aircraft operations is given in Table J-3. Stage lengths for air operations are given in Table J-4. It was assumed that there would be no engine runup activity for this alternative.

General aviation operations would be divided into the same general categories as in the Proposed Action. It was assumed that 41 percent of the single-engine and 16 percent of the multi-engine piston general aviation operations would be touch-and-go (or closed loop) activities. Daily operations assigned to each flight track and the time period for the Commercial Aviation Alternative are provided in Table J-11. A standard 3 degree glide slope and the takeoff profiles provided by the FAA's INM Database 4.11 were assumed for all aircraft.

Surface traffic data used in the modeling were developed from the project traffic study and are shown in Table J-7. The traffic mix, day/night split, and speed were assumed to remain the same as for the preclosure reference. Number of residents impacted was determined from the same sources as described under the Proposed Action.

1.6 RECREATION ALTERNATIVE

This alternative focuses on restoration and conservation of natural resources and includes only non-aviation land uses. The airfield would be replaced with public facilities/recreation and industrial development. Other land uses include institutional, commercial, and residential lands. Surface traffic data used in the modeling were developed from the project traffic study and are presented in Table J-7. The traffic mix, day/night split, and speed were assumed to remain the same as for the preclosure reference. Number of

Table J-10a. Annual Operations for the Commercial Aviation Alternative (2000)

Type of Aircraft	Number of Operations	Percent of Category	Total for Category	Category Percent of Total
Air Carrier			11,600	27.4
Beech 1900	2,552	22		
Saab 340	232	2		
ATR-42	8,352	72		
ATR-72	464	4		
General Aviation			30,700	72.6
Single Engine	23,700	77.2		
Multi-engine	5,000	16.3		
Turboprop	1,000	3.3		
Turbojet	1,000	3.3		
Total			42,300	

Table J-10b. Annual Operations for the Commercial Aviation Alternative (2005)

Type of Aircraft	Number of Operations	Percent of Category	Total for Category	Category Percent of Total
Air Carrier			13,000	27.0
Beech 1900	2,600	20		
Saab 340	650	5		
ATR-42	9,100	70		
ATR-72	650	5		
General Aviation			35,100	73.0
Single Engine	26,500	75.5		
Multi-engine	6,300	17.9		
Turboprop	1,300	3.7		
Turbojet	1,000	2.8		
Total			48,100	

Table J-10c. Annual Operations for the Commercial Aviation Alternative (2015)

Type of Aircraft	Number of Operations	Percent of Category	Total for Category	Category Percent of Total
Air Carrier			15,500	25.5
Beech 1900	2,325	15		
Saab 340	1,085	7		
ATR-42	10,540	68		
ATR-72	1,550	10		
General Aviation			45,400	74.5
Single Engine	34,000	74.9		
Multi-engine	8,500	18.7		
Turboprop	1,700	3.7		
Turbojet	1,200	2.6		
Total			60,900	

Table J-11a. Assignment of Operations for the Commercial Aviation Alternative (2000)

	D1L		D1S		D1R		D19L		D19S		D19R	
Aircraft	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night
Beech1900	0.82	-	0.82	-	0.82	-	0.35	-	0.35	-	0.35	-
Saab340	0.08	-	0.08	-	0.08	-	0.03	-	0.03	-	0.03	-
ATR-42	2.57	0.10	2.57	0.10	2.57	0.10	1.10	0.04	1.10	0.04	1.10	0.04
ATR-72	0.15	-	0.15	-	0.15	-	0.06	-	0.06	-	0.06	-
COMSEP	4.32	0.23	4.32	0.23	4.32	0.23	1.85	0.10	1.85	0.10	1.85	0.10
BEC58P	1.22	0.14	1.22	0.14	1.22	0.14	0.52	0.06	0.52	0.06	0.52	0.06
CNA442	0.27	0.05	0.27	0.05	0.27	0.05	0.12	0.02	0.12	0.02	0.12	0.02
G-IV	0.27	0.05	0.27	0.05	0.27	0.05	0.12	0.02	0.12	0.02	0.12	0.02

	A1		A19		T1L		T1R		T19L		T19R	
Aircraft	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night
Beech1900	2.45	-	1.05	-	-	-	-	-	-	-	-	-
Saab340	0.23	-	0.10	-	-	-	-	-	-	-	-	-
ATR-42	7.71	0.30	3.30	0.13	5.78	-	-	-	-	-	-	-
ATR-72	0.44	-	0.19	-	0.33	-	0.11	-	0.05	-	0.14	-
COMSEP	12.96	0.68	5.55	0.29	-	-	-	-	-	-	-	-
BEC58P	3.67	0.41	1.57	0.17	-	-	-	-	-	-	-	-
CNA442	0.82	0.14	0.35	0.06	-	-	-	-	-	-	-	-
G-IV	0.82	0.14	0.35	0.06	-	-	-	-	-	-	-	-
COMSEP	-	-	-	-	6.82	-	2.27	-	0.97	-	2.92	-
BEC58P	-	-	-	-	0.54	-	0.18	-	0.08	-	0.23	-

Table J-11b. Assignment of Operations for the Commercial Aviation Alternative (2005)

	D1L		D1S		D1R		D19L		D19S		D19R	
Aircraft	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night
Beech1900	0.83	-	0.83	-	0.83	-	0.36	-	0.36	-	0.36	-
Saab340	0.21	-	0.21	-	0.21	-	0.09	-	0.09	-	0.09	-
ATR-42	2.71	0.20	2.71	0.20	2.71	0.20	1.16	0.09	1.16	0.09	1.16	0.09
ATR-72	0.21	-	0.21	-	0.21	-	0.09	-	0.09	-	0.09	-
COMSEP	4.83	0.25	4.83	0.25	4.83	0.25	2.07	0.11	2.07	0.11	2.07	0.11
BEC58P	1.54	0.17	1.54	0.17	1.54	0.17	0.66	0.07	0.66	0.07	0.66	0.07
CNA442	0.36	0.06	0.36	0.06	0.36	0.06	0.15	0.03	0.15	0.03	0.15	0.03
G-IV	0.27	0.05	0.27	0.05	0.27	0.05	0.12	0.02	0.12	0.02	0.12	0.02
	A1		**A19**		**T1L**		**T1R**		**T19L**		**T19R**	
Aircraft	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night
Beech1900	2.49	-	1.07	-	-	-	-	-	-	-	-	-
Saab340	0.63	-	0.27	-	-	-	-	-	-	-	-	-
ATR-42	8.13	0.60	3.48	0.26	6.10	-	-	-	-	-	-	-
ATR-72	0.63	-	0.27	-	0.47	-	0.16	-	0.07	-	0.20	-
COMSEP	14.48	0.76	6.20	0.33	-	-	-	-	-	-	-	-
BEC58P	4.62	0.52	1.98	0.22	-	-	-	-	-	-	-	-
CNA442	1.07	0.19	0.46	0.08	-	-	-	-	-	-	-	-
G-IV	0.82	0.14	0.35	0.06	-	-	-	-	-	-	-	-
COMSEP	-	-	-	-	7.62	-	2.54	-	1.09	-	3.27	-
BEC58P	-	-	-	-	0.68	-	0.23	-	0.10	-	0.29	-

Table J-11c. Assignment of Operations for the Commercial Aviation Alternative (2015)

	D1L		D1S		D1R		D19L		D19S		D19R	
Aircraft	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night
Beech1900	0.74	-	0.74	-	0.74	-	0.32	-	0.32	-	0.32	-
Saab340	0.35	-	0.35	-	0.35	-	0.15	-	0.15	-	0.15	-
ATR-42	3.17	0.20	3.17	0.20	3.17	0.20	1.36	0.09	1.36	0.09	1.36	0.09
ATR-72	0.49	-	0.49	-	0.49	-	0.21	-	0.21	-	0.21	-
COMSEP	6.20	0.33	6.20	0.33	6.20	0.33	2.66	0.14	2.66	0.14	2.66	0.14
BEC58P	2.07	0.23	2.07	0.23	2.07	0.23	0.89	0.10	0.89	0.10	0.89	0.10
CNA442	0.46	0.08	0.46	0.08	0.46	0.08	0.20	0.03	0.20	0.03	0.20	0.03
G-IV	0.33	0.06	0.33	0.06	0.33	0.06	0.14	0.02	0.14	0.02	0.14	0.02

	A1		A19		T1L		T1R		T19L		T19R	
Aircraft	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night
Beech1900	2.23	-	0.95	-	-	-	-	-	-	-	-	-
Saab340	1.04	-	0.45	-	-	-	-	-	-	-	-	-
ATR-42	9.52	0.60	4.08	0.26	7.14	-	-	-	-	-	-	-
ATR-72	1.48	-	0.64	-	1.11	-	0.37	-	0.16	-	0.48	-
COMSEP	18.59	0.98	7.97	0.42	-	-	-	-	-	-	-	-
BEC58P	6.22	0.69	2.67	0.30	-	-	-	-	-	-	-	-
CNA442	1.39	0.24	0.59	0.10	-	-	-	-	-	-	-	-
G-IV	0.98	0.17	0.42	0.07	-	-	-	-	-	-	-	-
COMSEP	-	-	-	-	9.78	-	3.26	-	1.40	-	4.19	-
BEC58P	-	-	-	-	0.92	-	0.31	-	0.13	-	0.39	-

residents impacted was determined from the same sources as described under the Proposed Action.

1.7 NO-ACTION ALTERNATIVE

The No-Action Alternative would result in no further use of the base property regardless of whether or not the Air Force retains ownership of the property after closure. The property would not be put to further use. A disposal management team would be provided to ensure base security and maintain the grounds and physical assets, including the existing utilities and structures. There would be no military activities/missions performed on the property identified for disposal. Surface traffic data used in the modeling were developed from the project traffic study and are presented in Table J-7. The traffic mix, day/night split, and speed were assumed to remain the same as for the preclosure reference. Number of residents impacted was determined from the same sources as described under the Proposed Action.

2.0 NOISE METRICS

Noise, as used in this context, refers to sound pressure variations audible to the ear. The audibility of a sound depends on the amplitude and frequency of the sound and the individual's capability to hear the sound. Whether the sound is judged as noise depends largely on the listener's current activity and attitude toward the sound source, as well as the amplitude and frequency of the sound. The range in sound pressures which the human ear can comfortably detect encompasses a wide range of amplitudes, typically a factor larger than a million. To obtain convenient measurements and sensitivities at extremely low and high sound pressures, sound is measured in units of the dB. The dB is a dimensionless unit related to the logarithm of the ratio of the measured level to a reference level.

Because of the logarithmic nature of the decibel unit, sound levels cannot be added or subtracted directly. However, the following shortcut method can be used to combine sound levels:

Difference between two dB values	Add the following to the higher level
0 to 1	3
2 to 3	2
4 to 9	1
10 or more	0

The ear is not equally sensitive at all frequencies of sound. At low frequencies, characterized as a rumble or roar, the ear is not very sensitive while at higher frequencies, characterized as a screech or a whine, the ear is most sensitive. The A-weighted level was developed to measure and report sound levels in a way that would more closely approach how people

perceive the sound. All sound levels reported herein are in terms of A-weighted sound levels (dBA).

Environmental sound levels typically vary with time. This is especially true for areas near airports where noise levels will increase substantially as the aircraft passes overhead and afterwards diminish to typical community levels. Both the Department of Defense and the FAA have specified the following three noise metrics to describe aviation noise.

Day-Night Average Sound Level (DNL) is the 24-hour energy average A-weighted sound level with a 10 dB weighting added to those levels occurring between 10:00 p.m. and 7:00 a.m. the following morning. The 10 dB weighting is a penalty representing the added intrusiveness of noise during normal sleeping hours. DNL is used to determine land use compatibility with noise from aircraft and surface traffic. The expression L_{dn} is often used in equations to designate day-night average sound level.

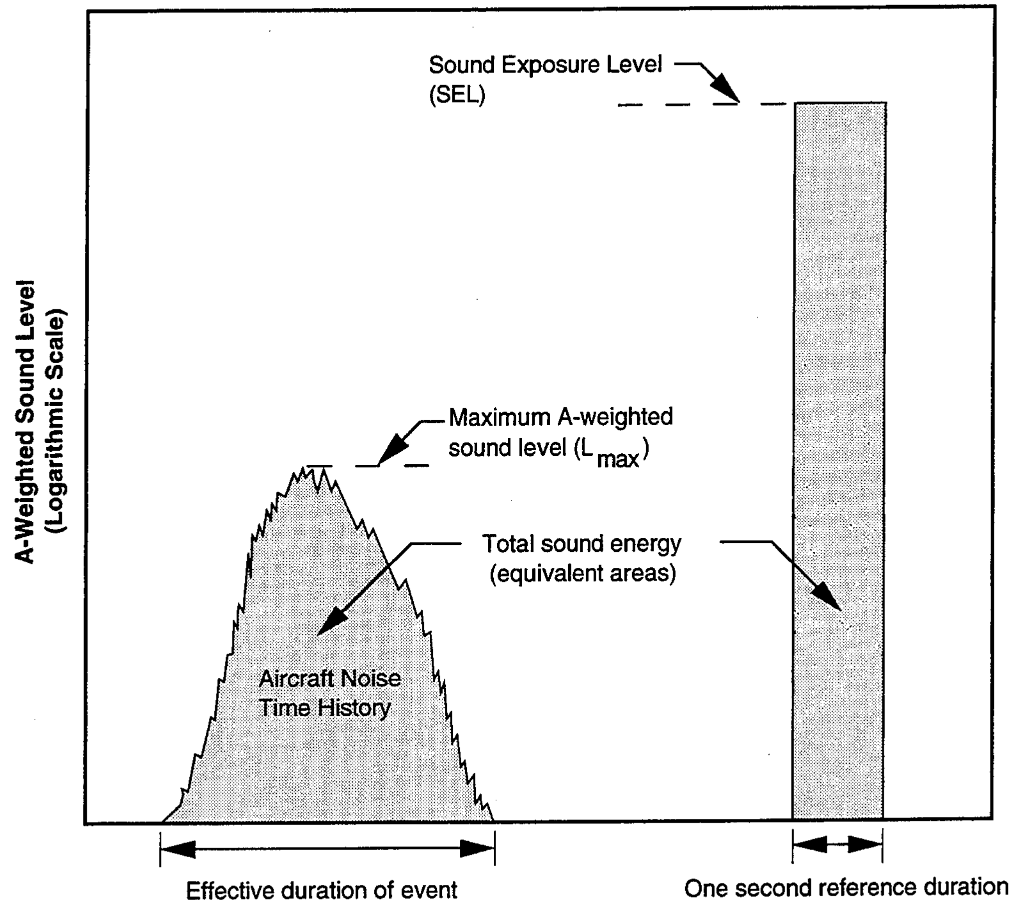
Maximum Sound Level is the highest instantaneous sound level observed during a single noise event no matter how long the sound may persist (Figure J-3).

Sound Exposure Level (SEL) value represents the A-weighted sound level integrated over the entire duration of the event and referenced to a duration of 1 second. Hence, it normalizes the event to a 1-second event. Typically, most events (aircraft flyover) last longer than 1 second, and the SEL value will be higher than the maximum sound level of the event. Figure J-3 illustrates the relationship between the maximum sound level and SEL.

3.0 NOISE MODELS

3.1 AIR TRAFFIC

The FAA-approved INM version 4.11 is a computerized overflight noise prediction model originally developed by the Transportation Systems Center of the U.S. Department of Transportation. This model has been specified as acceptable for FAA-funded Part 150 noise studies. The model accounts for separate aircraft flying along flight tracks defined as straight-line or curved segments, during an annual average 24-hour period at an airport. These flight tracks are coupled with separate tables in the computer program's data base relating to the noise, velocity, distance, and engine thrust for each district aircraft type selected. The individual aircraft noise exposures are then summed for each location on a grid around the airport. The cumulative values of noise exposure at each grid location may then be used to interpolate equal noise exposure contours for preselected DNL values.



Sound Exposure Level and Comparison to Aircraft Noise Time History

Figure J-3

3.2 SURFACE TRAFFIC

The FHWA Highway Traffic Noise Prediction Noise Model was used to predict surface traffic noise. The model uses traffic volumes, vehicular mix, traffic speed, traffic distribution, and roadway length to estimate traffic noise levels.

4.0 ASSESSMENT CRITERIA

Criteria for assessing the effects of noise include annoyance, speech interference, sleep disturbance, noise-induced hearing loss, possible nonauditory health effects, reaction by animals, and land use compatibility. These criteria are often developed using statistical methods. The validity of generalizing statistics derived from large populations is suspect when these statistics are applied to small sample sizes as they have been in the affected areas near K. I. Sawyer AFB. Caution should be employed when interpreting the results of the impact analysis.

4.1 ANNOYANCE DUE TO SUBSONIC AIRCRAFT NOISE

Noise-induced annoyance is an attitude or mental process with both acoustic and nonacoustic determinants (Fidell et al., 1988). Noise-induced annoyance is perhaps most often defined as a generalized adverse attitude toward noise exposure. Noise annoyance is affected by many factors including sleep and speech interference and task interruption. The level of annoyance may also be affected by many nonacoustic factors.

In communities in which the prevalence of annoyance is affected primarily by noise, reductions in exposure can be expected to lead to reductions in prevalence of annoyance. In communities in which the prevalence of annoyance is controlled by nonacoustic factors, such as odor, traffic congestion, etc., there may be little or no reduction in annoyance associated with reductions in exposure. The intensity of community response to noise exposure may even, in some cases, be essentially independent of physical exposure. In the case of community response to actions, such as airport siting or scheduling of supersonic transport aircraft, vigorous reaction has been encountered at the mere threat of exposure, or minor increases in exposure.

The standard method for determining the prevalence of annoyance in noise-exposed communities is by attitudinal survey. Surveys generally solicit self-reports of annoyance through one or more questions of the form "How bothered or annoyed have you been by the noise of (noise source) over the last (time period)?" Respondents are typically constrained in structured interviews to select one of a number of response alternatives, often named categories such as "Not At All Annoyed," "Slightly Annoyed," "Moderately Annoyed," "Very Annoyed," or "Extremely Annoyed." Other means are

sometimes used to infer the prevalence of annoyance from survey data (for example, by interpretation of responses to activity interference questions or by construction of elaborate composite indices), with varying degrees of face validity and success.

Predictions of the prevalence of annoyance in a community can be made by extrapolation from an empirical dosage-effect relationship. Based on the results of a number of sound surveys, Schultz (1978) developed a relationship between percent highly annoyed and DNL:

$$\%\ \textit{Highly Annoyed} = 0.8553\ DNL - 0.0401\ DNL^2 + 0.00047\ DNL^3$$

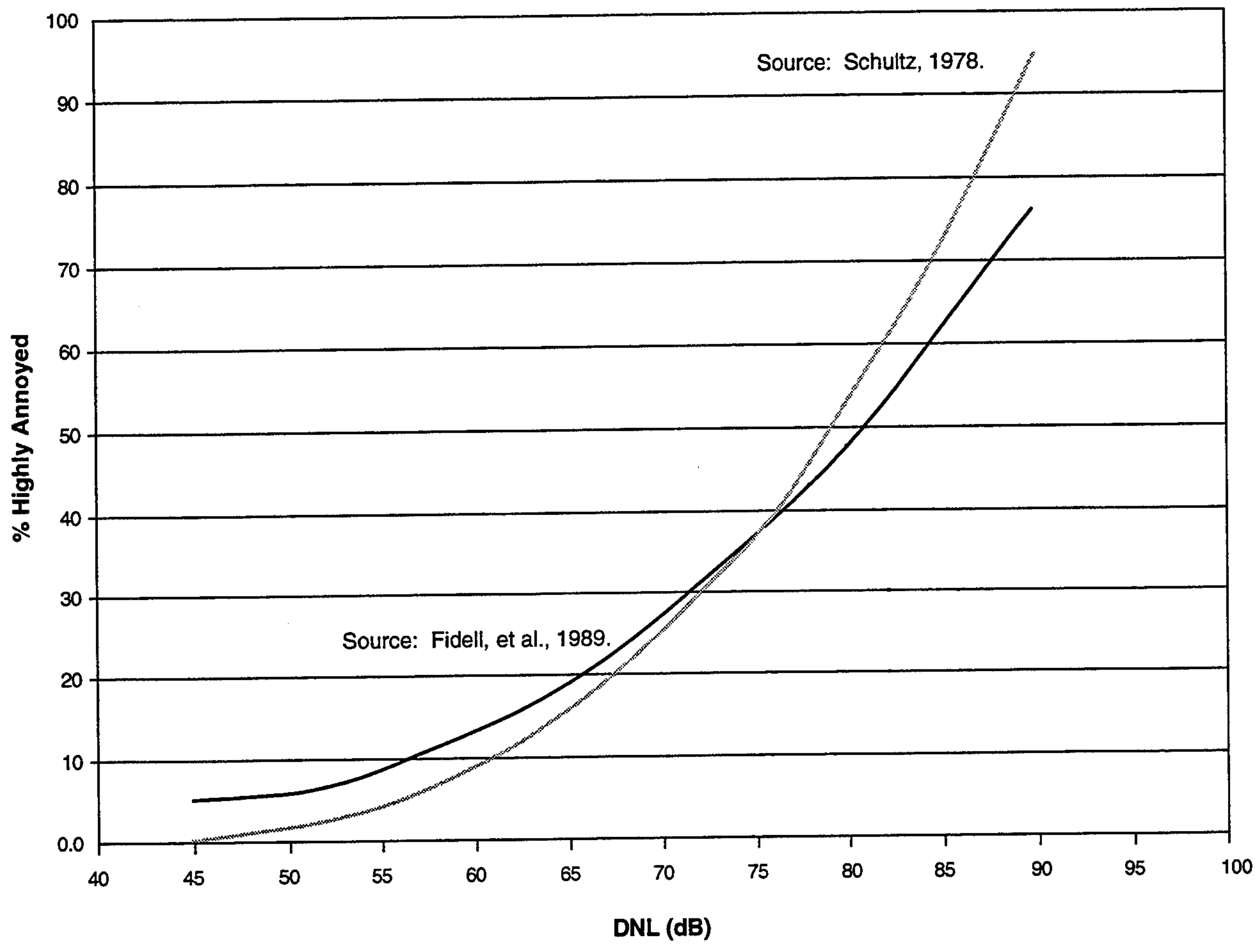
Note that this relationship should not be evaluated outside the range of DNL = 45 to 90 dB. Figure J-4 presents this equation graphically. Less than 15 to 20 percent of the population would be predicted to be annoyed by DNL values less than 65 dB, whereas over 37 percent of the population would be predicted to be annoyed from DNL values greater than 75 dB. The relationship developed by Schultz was presented in the Guidelines for Preparing Environmental Impact Statements on Noise (National Academy of Science, 1977).

These results were recently reviewed (Fidell et al., 1989) and the original findings were updated with the results of more recent social surveys, bringing the number of data points used in defining the relationship to over 400. The findings of the new study differ only slightly from those of the original study.

4.2 SPEECH INTERFERENCE AND RELATED EFFECTS DUE TO AIRCRAFT FLYOVER NOISE

One of the ways that noise affects daily life is by preventing or impairing speech communication. In a noisy environment, understanding of speech is diminished by masking of speech signals by intruding noises. Speakers generally raise their voices or move closer to listeners to compensate for masking noise in face-to-face communications, thereby increasing the level of speech at the listener's ear. As intruding noise levels rise higher and higher, speakers may cease talking altogether until conversation can be resumed at comfortable levels of vocal effort after noise intrusions end.

If the speech source is a radio or television, the listener may increase the volume during a noise intrusion. If noise intrusions occur repeatedly, the listener may choose to set the volume at a high level so that the program material can be heard even during noise intrusions.



Community Noise Annoyance Curves

Figure J-4

In addition to losing information contained in the masked speech material, the listener may lose concentration because of the interruptions and thus become annoyed. If the speech message is some type of warning, the consequences could be serious.

Current practice in quantification of the magnitude of speech interference and predicting speech intelligibility ranges from metrics based on A-weighted sound pressure levels of the intruding noise alone to more complex metrics requiring detailed spectral information about both speech and noise intrusions. There are other effects of the reduced intelligibility of speech caused by noise intrusions. For example, if the understanding of speech is interrupted, performance may be reduced, annoyance may increase, and learning may be impaired.

As the noise level of an environment increases, people automatically raise their voices. The effect does not take place, however, if the noise event rises to a high level very suddenly.

4.2.1 Speech Interference Effects from Time-Varying Noise

Most research on speech interference due to noise has included the study of steady state noise. As a result, reviews and summaries of noise effects on speech communications concentrate on continuous or at least long duration noises (Miller, 1974). However, noise intrusions are not always continuous or of long duration, but are frequently transient in nature. Transportation noise generates many such noise intrusions, consisting primarily of individual vehicle pass-bys, such as aircraft flyovers. Noise emitted by other vehicles (motorboats, snowmobiles, and off-highway vehicles) is also transient in nature.

It has been shown, at least for aircraft flyover noise, that accuracy of predictors of speech intelligibility is ranked in a similar fashion for both steady state and time-varying or transient sounds (Williams et al., 1971; Kryter and Williams, 1966). Of course, if one measures the noise of a flyover by the maximum A-weighted level, intelligibility associated with this level would be higher than for a steady noise of the same value, simply because the level is less than the maximum for much of the duration of the flyover.

4.2.2 Other Effects of Noise Which Relate to Speech Intelligibility

Aside from the direct effects of reduction in speech intelligibility, related effects may occur that tend to compound the loss of speech intelligibility itself.

Learning. One of the environments in which speech intelligibility plays a critical role is the classroom. In classrooms of schools exposed to aircraft

flyover noise, speech becomes masked or the teacher stops talking altogether during an aircraft flyover (Crook and Langdon, 1974). Pauses begin to occur when instantaneous flyover levels exceed 60 dB. Masking of the speech of teachers who do not pause starts at about the same level.

At levels of 75 dB some masking occurs for 15 percent of the flyovers and increases to nearly 100 percent at 82 dB. Pauses occur for about 80 percent of the flyovers at this noise level. Since a marked increase in pauses and masking occurs when levels exceed 75 dB, this level is sometimes considered as one above which teaching is impaired due to disruption of speech communication. The effect that this may have on learning is unclear at this time. However, one study (Arnoult et al., 1986) could find no effect of noise on cognitive tasks from jet or helicopter noise over a range from 60 to 80 dB (A-level), even though intelligibility scores indicated a continuous decline starting at the 60 dB level. In a Japanese study (Ando et al., 1975) researchers failed to find differences in mental task performance among children from communities with different aircraft noise exposure.

Although there seems to be no proof that noise from aircraft flyovers affects learning, it is reported by Mills (1975) that children are not as able to understand speech in the presence of noise as are adults. It is hypothesized that part of the reason is due to the increased vocabulary which the adult can draw on as compared to the more limited vocabulary available to the young student. Also, when one is learning a language, it is more critical that all words be heard rather than only enough to attain 95 percent sentence intelligibility, which may be sufficient for general conversations. It was mentioned above that when the maximum A-level for aircraft flyovers heard in a classroom exceeds 75 dB, masking of speech increases rapidly. However, it was also noted that pausing during flyovers and masking of speech for those teachers who continue to lecture during a flyover start at levels around 60 dB (Pearsons and Bennett, 1974).

Animals. Literature concerning the effects of noise on animals is not large, and most of the studies have focused on the relation between dosages of continuous noise and effects (Belanovskii and Omel'yanenko, 1982; Ames, 1974). A literature survey (Kull and Fisher, 1986) found that the literature is inadequate to document long-term or subtle effects of noise on animals. No controlled study has documented any serious accident or mortality on livestock despite extreme exposure to noise.

Annoyance. Klatt, Stevens, and Williams (1969) studied the annoyance of speech interference by asking people to judge the annoyance of aircraft noise in the presence and absence of speech material. The speech material was composed of passages from newspaper and magazine articles. In addition to rating aircraft noise on an acceptability scale (unacceptable, barely acceptable, acceptable, and of no concern), the subjects were

required to answer questions about the speech material. The voice level was considered to represent a raised voice level (assumed to be 68 dB). In general, for the raised voice talker, the rating of barely acceptable was given to flyover noise levels of 73 to 76 dB. However, if the speech level was reduced, the rating of the aircraft tended more toward unacceptable. The results suggested that if the speech level were such that 95 percent or better sentence intelligibility was maintained, then a barely acceptable rating or better acceptability rating could be expected. This result is in general agreement with the finding in schools that teachers pause or have their speech masked at levels above 75 dB (Crook and Langdon, 1974).

Hall, Taylor, and Birnie (1985) recently tried to relate various types of activity interference in the home, related to speech and sleeping, to annoyance. The study found that there is a 50 percent chance that people's speech would be interfered with at a level of 58 dB. This result is in agreement with the other results, considering that the speech levels in the school environment of the Cook study are higher than the levels typically used in the home. Also, in a classroom situation the teacher raises his or her voice as the flyover noise increases in intensity.

4.2.3 Predicting Speech Intelligibility and Related Effects Due to Aircraft Flyover Noise

It appears from the above discussions that when aircraft flyover noises exceed approximately 60 dB, speech communication may be interfered with either by masking or by pausing on the part of the talker. Increasing the level of the flyover noise to 80 dB would reduce the intelligibility to zero even if a loud voice is used by those attempting to communicate.

The levels mentioned above refer to noise levels measured indoors. The same noises measured outdoors would be 15 to 25 dB higher than these indoor levels during summer (windows open) and winter months (windows closed), respectively. These estimates are taken from Environmental Protection Agency (EPA) reviews of available data (U.S. EPA, 1974).

Aircraft noise levels measured inside dwellings and schools near the ends of runways at airports may exceed 60 dB (75 dB outside). During flyovers, speech intelligibility would be degraded. However, since the total duration is short, no more than a few seconds during each flyover, only a few syllables may be lost. People may be annoyed, but the annoyance may not be due to loss in speech communication, but rather to startle or sleep disturbance as discussed below.

4.3 SLEEP DISTURBANCE DUE TO NOISE

The effects of noise on sleep have long been a concern of parties interested in assuring suitable residential noise environments. Early studies noted background levels in people's bedrooms in which sleep was apparently undisturbed by noise. Various levels between 25 to 50 dB were observed to be associated with an absence of sleep disturbance. The bulk of the research on noise effects on which the current relationship is based was conducted in the 1970s. The tests were conducted in a laboratory environment in which awakening was measured either by a verbal response or by a button push, or by brain wave recordings (electroencephalograms) indicating stages of sleep (and awakening). Various types of noise were presented to the sleeping subjects throughout the night. These consisted primarily of transportation noises, including those produced by aircraft, trucks, cars and trains. The aircraft noises included both flyover noises and sonic booms. Synthetic noises, including laboratory-generated sounds consisting of shaped noises and tones, were also studied.

Lukas (1975) and Goldstein and Lukas (1980) both reviewed data available in the 1970s on sleep-stage changes and waking effects of different levels of noise. Since no known health effects were associated with either waking or sleep-stage changes, either measure was potentially useful as a metric of sleep disturbance. However, since waking, unlike sleep-stage changes, is simple to quantify, it is often selected as the metric for estimating the effects of noise on sleep. These two reviews showed great variability in the percentage of people awakened by exposure to noise. The variability is not merely random error, but reflects individual differences in adaptation or habituation, and also interpretation of the meaning of the sounds. Such factors cannot be estimated from the purely acoustic measures in noise exposure.

Another major review, by Griefahn and Muzet (1978), provided similar information for effects of noise on waking. However, Griefahn and Muzet's results suggested less waking for a given level of noise than predicted by Lukas.

A recent review (Pearsons et al., 1989) of the literature related to sleep disturbance demonstrated that the relationship, based exclusively on laboratory studies, predicts greater sleep disturbance than that likely to occur in a real-life situation in which some adaptation has occurred. The prediction relationships developed in this review should not be considered to yield precise estimates of sleep disturbance because of the great variability in the data sets from which they were developed. The relationships include only the duration and level components of "noise exposure." Increasing the precision of prediction would depend on quantification of some of the nonacoustic factors. Further, a recent review of field as well as laboratory

studies suggests that habituation may reduce the effect of noise on sleep (Pearsons et al., 1989).

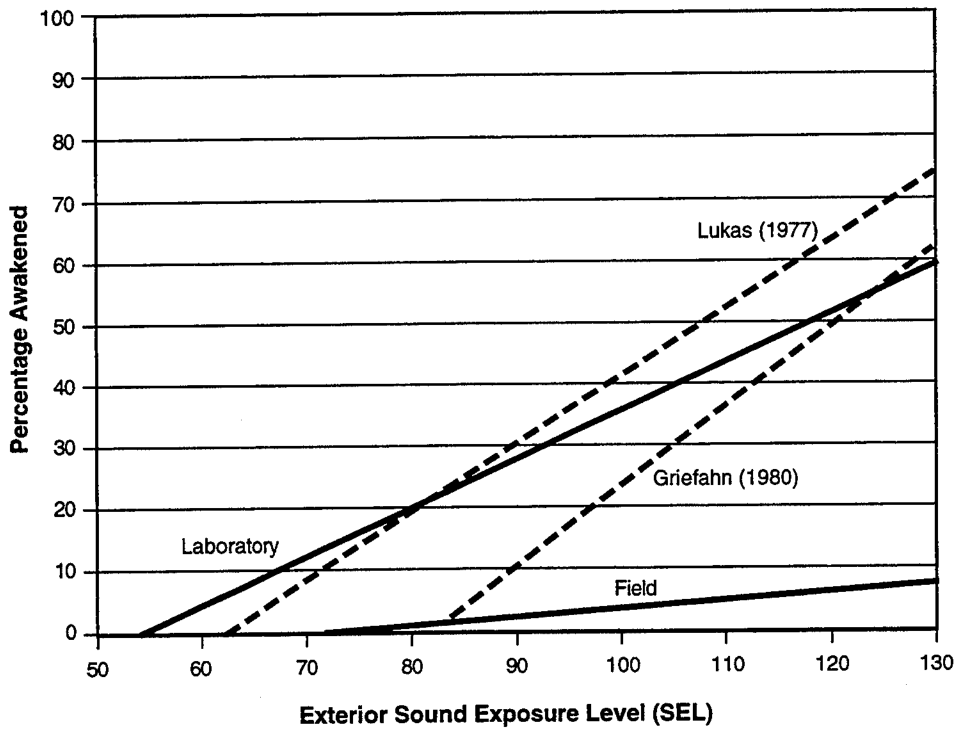
Noise must penetrate the home to disturb sleep. Interior noise levels are lower than exterior levels due to the attenuation of the sound energy by the structure. The amount of attenuation provided by the building is dependent on the type of construction and whether the windows are open or closed. The approximate national average attenuation factors are 15 dB for open windows and 25 dB for closed windows (U.S. EPA, 1974).

Incorporating these attenuation factors, the percent awakened relationships previously discussed under summer conditions are presented in Figure J-5. In conclusion, the scientific literature does not provide a consensus on sleep disturbance. There is no recognized criteria or standard which provides guidance to assess sleep disturbance due to noise.

4.4 NOISE-INDUCED HEARING LOSS

Hearing loss is measured in decibels and refers to the permanent auditory threshold shift of an individual's hearing in an ear. Auditory threshold refers to the minimum acoustic signal that evokes an auditory sensation, i.e., the quietest sound a person can hear. When a threshold shift occurs a person's hearing is not as sensitive as before, and the minimum sound that a person can hear must be louder. The threshold shift that naturally occurs with age is called presbycusis. Exposure to high levels of sound can cause temporary and permanent threshold shifts usually referred to as noise-induced hearing loss. Permanent hearing loss is generally associated with destruction of the hair cells of the inner ear.

The U. S. EPA (1974) and the Committee on Hearing, Bioacoustics, and Biomechanics (National Academy of Sciences, 1981) have addressed the risk of outdoor hearing loss. They have concluded that hearing loss would not be expected for people living outside the DNL 75 dB noise contour. Several studies of populations near existing airports in the U.S. and the U.K. have shown that the possibility for permanent hearing loss in communities near intense commercial take-off and landing patterns is remote. An FAA-funded study compared the hearing of the population near the Los Angeles International Airport to that of the population in a quiet area away from aircraft noise (Parnel et al., 1972). A similar study was performed in the vicinity of London Heathrow Airport (Ward et al., 1972). Both studies concluded that there was no significant difference between the hearing loss of the two populations, and no correlation between the hearing level with the length of time people lived in the airport neighborhood.



Source: Pearsons, et al.,1989

Sleep Disruption (Awakening)

Figure J-5

4.5 NONAUDITORY HEALTH EFFECTS OF RESIDENTIAL AIRCRAFT NOISE

Based on summaries of previous research in the field (Thompson, 1981; Thompson and Fidell, 1989), predictions of nonauditory health effects of aircraft noise cannot be made. A valid predictive procedure requires: (1) evidence for causality between aircraft noise exposure and adverse nonauditory health consequences, and (2) knowledge of a quantitative relationship between amounts of noise exposure (dose) and specific health effects. Because results of studies of aircraft noise on health are equivocal, there is no sound scientific basis for making adequate risk assessments. Alleged nonauditory health consequences of aircraft noise exposure that have been studied include birth defects, low birth weight, psychological illness, cancer, stroke, hypertension, sudden cardiac death, myocardial infarction, and cardiac arrhythmias. Of these, hypertension is the most biologically plausible effect of noise exposure. Noise appears to cause many of the same biochemical and physiological reactions, including temporary elevation of blood pressure, as do many other environmental stressors. These temporary increases in blood pressure are believed to lead to a gradual resetting of the body's blood pressure control system. Over a period of years, permanent hypertension may develop (Peterson et al., 1984).

Studies of residential aircraft noise have produced contradictory results. Early investigations indicated that hypertension was from two to four times higher in areas near airports than in areas located away from airports (Karagodina et al., 1969). Although Meecham and Shaw (1988) continue to report excessive cardiovascular mortality among individuals 75 years or older living near the Los Angeles International Airport, their findings cannot be replicated (Frerichs et al., 1980). In fact, noise exposure increased over the years while there was a decline in all cause, age-adjusted death rates and inconsistent changes in age-adjusted cardiovascular, hypertension, and cerebrovascular disease rates.

Studies that have controlled for multiple factors have shown no, or a very weak, association between noise exposure and nonauditory health effects. This observation holds for studies of occupational and traffic noise as well as for aircraft noise exposure. In contrast to the early reports of two- to six-fold increases in hypertension due to high industrial noise (Thompson and Fidell, 1989), the more rigorously controlled studies of Talbott et al. (1985) and van Dijk et al (1987) show no association between hypertension and prolonged exposure to high levels of occupational noise.

In the aggregate, studies indicate that no association exists between street traffic noise and blood pressure or other cardiovascular changes. Two large prospective collaborative studies of heart disease are of particular interest. To date, cross-sectional data from these cohorts offer contradictory results. Data from one cohort show a slight increase in mean systolic blood pressure (2.4 millimeters of mercury) in the noisiest compared to the quietest area;

while data from the second cohort show the lowest mean systolic blood pressure and highest high-density lipoprotein cholesterol (lipoprotein protective of heart disease) for men in the noisiest area (Babisch and Gallacher, 1990). These effects of traffic noise on blood pressure and blood lipids were more pronounced in men who were also exposed to high levels of noise at work.

It is clear from the foregoing that the current state of technical knowledge cannot support inference of a causal or consistent relationship, nor a quantitative dose-response, between residential aircraft noise exposure and health consequences. Thus, no technical means are available for predicting extra-auditory health effects of noise exposure. This conclusion cannot be construed as evidence of no effect of residential aircraft noise exposure on nonauditory health. Current findings, taken in sum, indicate only that further rigorous studies are needed.

4.6 DOMESTIC ANIMALS AND WILDLIFE

A recent study was published on the effects of aircraft noise on domestic animals which provided a review of the literature and a review of 209 claims pertinent to aircraft noise over a period spanning 32 years (Bowles et al., 1990). Studies since the late 1950s were motivated both by public concerns about what was at that time a relatively novel technology, supersonic flight, and by claims leveled against the U. S. Air Force for damage done to farm animals by very low-level subsonic overflights. Since that time over 40 studies of aircraft noise and sonic booms, both in the U.S. and overseas, have addressed acute effects, including effects of startle responses (sheep, horses, cattle, fowl), and effects on reproduction and growth (sheep, cattle, fowl, swine), parental behaviors (fowl, mink), milk letdown (dairy cattle, dairy goats, swine), and egg production.

The literature on the effects of noise on domestic animals is not large, and most of the studies have focused on the relation between dosages of continuous noise and effects. Chronic noises are not a good model for aircraft noise, which lasts only a few seconds, but which is often very startling. The review of claims suggests that a major source of loss was panics induced in naive animals.

Aircraft noise may have effects because it might trigger a startle response, a sequence of physiological and behavioral events that once helped animals avoid predators. There are good dose-response relations describing the tendency to startle to various levels of noise, and the effect of habituation on the startle response.

The link between startles and serious effects (i.e., effects on productivity) is less certain. Here, we will define an effect as any change in a domestic animal that alters its economic value, including changes in body weight or

weight gain, numbers of young produced, weight of young produced, fertility, milk production, general health, longevity, or tractability. At this point, changes in productivity are usually considered an adequate indirect measure of changes in well being, at least until objective legal guidelines are provided.

Recent focus on the effects on production runs counter to a trend in the literature toward measuring the relation between noise and physiological effects, such as changes in corticosteroid levels, and in measures of immune system function. As a result, it is difficult to determine the relation between dosages of noise and serious effects using only physiological measures. The experimental literature is inadequate to document long-term or subtle effects resulting from exposure to aircraft noise.

4.7 LAND USE COMPATIBILITY GUIDELINES

Widespread concern about the noise impacts of aircraft noise essentially began in the 1950s, a decade that saw the major introduction of high power jet aircraft into military service. The concern about noise impacts in the communities around airbases, and also within the airbases themselves, led the Air Force to conduct major investigations into the noise properties of jets, methods of noise control for test operations, and the effects of noise from aircraft operations in communities surrounding airbases. These studies established an operational framework of investigation and identified the basic parameters affecting community response to noise. These studies also resulted in the first detailed procedures for estimating community response to aircraft noise (Stevens and Pietrasanta, 1957).

Although most attention was given to establishing methods of estimating residential community response to noise (and establishing the conditions of noise "acceptability" for residential use), community development involves a variety of land uses with varying sensitivity to noise. Thus, land planning with respect to noise requires the establishment of noise criteria for different land uses. This need was met with the initial development of aircraft noise compatibility guidelines for varied land uses in the mid-1960s (Bishop, 1964).

In residential areas, noise intrusions generate feelings of annoyance on the part of individuals. Increasing degrees of annoyance lead to the increasing potential for complaints and community actions (most typically, threats of legal actions, drafting of noise ordinances, etc.). Annoyance is based largely upon noise interference with speech communication, listening to radio and television, and sleep. Annoyance in the home may also be based upon dislike of "outside" intrusions of noise even though no specific task is interrupted.

Residential land use guidelines have developed from consideration of two related factors:

(a) Accumulated case history experience of noise complaints and community actions near civil and military airports;

(b) Relationships between environmental noise levels and degrees of annoyance (largely derived from social surveys in a number of communities).

In the establishment of land use guidelines for other land uses, the prime consideration is task interference. For many land uses, this translates into the degree of speech interference, after taking into consideration the importance of speech communication and the presence of non-aircraft noise sources related directly to the specific land use considered. For some noise-sensitive land uses where any detectable noise signals that rise above the ambient noise are unwanted (such as music halls), detectability may be the criterion rather than speech interference.

A final factor to be considered in all land uses involving indoor activities is the degree of noise insulation provided by the building structures. The land use guideline limits for unrestricted development within a specific land use assume noise insulation properties provided by typical commercial building construction. The detailed land use guidelines may also define a range of higher noise exposure where construction or development can be undertaken, provided a specified amount of noise insulation is included in the buildings. Special noise studies, undertaken by architectural or engineering specialists, may be needed to define the special noise insulation requirements for construction in these guideline ranges.

Estimates of total noise exposure resulting from aircraft operations, as expressed in DNL values, can be interpreted in terms of the probable effect on land uses. Suggested compatibility guidelines for evaluating land uses in aircraft noise exposure areas were originally developed by the FAA as presented in Section 3.4.4, Noise. Part 150 of the FAA regulations prescribes the procedures, standards, and methodology governing the development, submission, and review of airport noise exposure maps and airport noise compatibility programs. It prescribes the use of yearly DNL in the evaluation of airport noise environments. It also identifies those land use types that are normally compatible with various levels of noise exposure. Compatible or incompatible land use is determined by comparing the predicted or measured DNL level at a site with the values given in the table. The guidelines reflect the statistical variability of the responses of large groups of people to noise. Therefore, any particular level might not accurately assess an individual's perception of an actual noise environment.

While the FAA guidelines specifically apply to aircraft noise, it should be noted that DNL is also used to describe the noise environment due to other community noise sources, including motor vehicles and railroads. The use of DNL is endorsed by the scientific community to assess land use compatibility as it pertains to noise (American National Standards Institute, 1990). Hence, the land use guidelines presented by the FAA can also be used to assess the noise impact from community noise sources other than aircraft.

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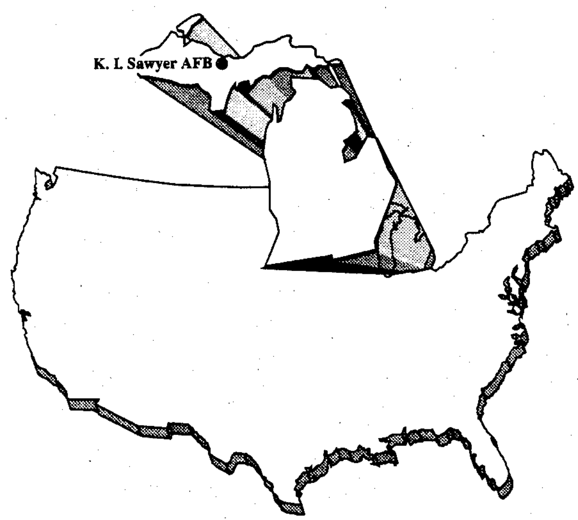

APPENDIX K

APPENDIX K

BIOLOGICAL RESOURCES

Table K-1. Plant and Wildlife Species Reported on K. I. Sawyer AFB

Common Name	Scientific Name
Plants	
Balsam fir[a]	*Abies balsamea*
Crimson king maple	*Acer platanoides*
Norway maple	*Acer platanoides columna*
Red maple	*Acer rubrum*
Sugar maple[a]	*Acer saccharum*
Red alder	*Alnus rubra*
Oblong-leaf juneberry	*Amelanchier canadensis*
Serviceberry[a]	*Amelanchier* sp.
Weigela	*Atro purpurea*
Paper birch	*Betula papyrifera*
Bladder sedge	*Carex intumescans*
Lurid sedge	*Carex lurida*
Tussock sedge	*Carex stricta*
Bristlebract sedge	*Carex tribuloides*
Fox sedge	*Carex vulpinoidea*
Leatherleaf shrub	*Chamaedaphne calyculata*
Varigated dogwood	*Cornus alba argentea (marginata)*
Bailey's red-twig dogwood	*Cornus baileyi*
Bunchberry[a]	*Cornus canadensis*
Moccasin-flower[a]	*Cypripedium acaule*
Tufted hairgrass	*Deschampsia cespitosa*
Dwarf bush honeysuckle	*Diervilla lanicera*
Beaked spikerush	*Eleocharis rostellata*
Water horsetail	*Equisetum fluviatile*
Big leaf winter creeper	*Euonymus fortunei* "Vegetus"
Dwarf-winged euronymus	*Euronymus alotus compacta*
Red fescue	*Festuca rubra*
Autumn purple ash	*Fraxinus americana*
Fir clubmoss[b]	*Huperzia selago*
Pennywort	*Hydrocotyl* sp.
Canada rush	*Juncus canadensis*
Pfitzer juniper	*Juniperus chinensis pfitzeriana*
Blue sargent juniper	*Juniperus chinensis* "Sargent Glauca"
Andorra juniper	*Juniperus horizontalis*
Japgarden juniper	*Juniperus procumbens*
Dundee juniper	*Juniperus virginiana (hilli)*
Pale laurel[a]	*Kalmia polifolia*
American larch (tamarack)[a]	*Larix laricina*
Labrador tea[a]	*Ledum groenlandicum*

Table K-1. Plant and Wildlife Species Reported on K. I. Sawyer AFB
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Common Name	Scientific Name
Duckweed	*Lemna* sp.
Perennial rye	*Lolium* sp.
Dolgo crabapple	*Malus dolga*
Red weeping jade crabapple	*Malus* sp."Red Jade"
James' monkey-flower[b]	*Mimulus glabratus* var. *jamesii*
Water lily[a]	*Nymphea* sp.
Reed canary grass	*Phalaris arundenacia*
Phragmites	*Phragmites communis*
Black spruce[a]	*Picea mariana*
Colorado blue spruce	*Picea pungens glauca* "Shiner"
Koster's blue spruce	*Picea pungens koster*
Jack pine[a]	*Pinus banksiana*
Red pine[a]	*Pinus resinosa*
Scotch pine	*Pinus sylvestris*
Kentucky blue grass	*Poa pratensis*
Fringed polygala[a]	*Polygala pauciflora*
Balsam poplar	*Populus balsamifera*
Eastern cottonwood	*Populus deltoides*
Quaking aspen[a]	*Populus tremuloides*
Potentilla	*Potentilla fruiticosa*
Pin cherry[a]	*Prunus pensylvanica*
Sand cherry[a]	*Prunus pumila*
Canada red cherry (choke cherry)	*Prunus virginiana* "Shubert"
Douglas fir	*Pseudotsuga menziesii*
Bracken fern[a]	*Pteridium aquilinum*
Red oak[a]	*Quercus rubra*
Dock	*Rumex* sp.
Weeping willow	*Salix alba tristis*
Black willow	*Salix nigra*
Soft-stem bullrush	*Scirpus validus*
Mountain ash	*Sorbus aucuparia* (European)
Sphagnum moss[a]	*Sphagnum* spp.
Chinese lilac	*Syringa chinensis*
Hatfield yew	*Taxus media hatfieldia*
Northern white cedar	*Thuja occidentalis*
Glove arborvitae	*Thuja occidentalis globosa*
Basswood	*Tilia americana*
Little leaf linden	*Tilia cordata*
Greenspire linden	*Tilia cordata* "Greenspire"
White clover	*Trifolium* sp.

Table K-1. Plant and Wildlife Species Reported on K. I. Sawyer AFB

Common Name	Scientific Name
Cattail	*Typha latifolia*
Late low blueberry[a]	*Vaccinium vacillans*
Cranberry bush	*Viburnum trilobum compacta*
Invertebrates	
Frigga fritillary[b]	*Boloria frigga*
Fish	
Rockbass	*Ambloplites rupestris*
Black bullhead	*Ameiurus melas*
Quillback carpsucker	*Carpiodes cyprinus*
White sucker	*Catostomus commersoni*
Cisco	*Coregonus artedii*
Sculpin	*Cottus* sp.
Brook stickleback	*Culaea inconstans*
Common carp	*Cyprinus carpo*
Northern pike	*Esox lucius*
Muskellunge	*Esox masquinongy*
Johnny darter	*Etheostoma nigrum*
Banded topminnow	*Fundulus diaphanus*
Brassy minnow	*Hybognathus hankinsoni*
Lamprey	*Ichthyomyzon* sp.
Brown bullhead	*Ictalurus nebulosus*
American brook lamprey	*Lampetra appendix*
Longnose gar	*Lepisosteus osseus*
Pumpkinseed	*Lepomis gibbosus*
Burbot	*Lota lota*
Smallmouth bass	*Micropterus dolomieui*
Largemouth bass	*Micropterus salmoides*
Shorthead redhorse	*Moxostoma macrolepidatum*
Greater redhorse	*Moxostoma valenciennesi*
Common shiner	*Notropis cornutus*
Blacknose shiner	*Notropis heterodon*
Sand shiner	*Notropis stramineus*
Mimic shiner	*Notropis volucellus*
Tadpole madtom	*Noturus gyrinus*
Rainbow trout	*Oncorhynchus mykiss*
Yellow perch	*Perca flavescens*
Logperch	*Percina caprodes*
Trout perch	*Percopsis omiscomaycus*

Table K-1. Plant and Wildlife Species Reported on K. I. Sawyer AFB

Common Name	Scientific Name
Bluntnose minnow	*Pimephales notatus*
Fathead minnow	*Pimephales promelas*
Brown trout	*Salmo trutta*
Brook trout	*Salvelinus fontinalis*
Creek chub	*Semotilus atromaculatus*
Pearl dace	*Semotilus margarita*
Walleye	*Stizostedion vitreum*
Central mudminnow	*Umbra limi*
Amphibians	
Spotted salamander	*Ambystoma maculatum*
American toad	*Bufo americanus*
Spring peeper	*Hyla crucifer*
Common gray treefrog	*Hyla versicolor*
Mudpuppy	*Necturus maculosus*
Eastern newt	*Notophthalmus viridescens*
Red-backed salamander	*Plethodon cinereus*
Striped chorus frog	*Pseudacris triseriata*
Bullfrog	*Rana catesbeiana*
Green frog	*Rana clamitans*
Pickerel frog	*Rana palustris*
Northern leopard frog	*Rana pipiens*
Wood frog	*Rana sylvatica*
Reptiles	
Snapping turtle	*Chelydra serpentina*
Painted turtle	*Chrysemys picta*
Wood turtle	*Clemmys insculpta*
Eastern ringneck snake	*Diadophis punctatus*
Fox snake	*Elaphe vulpina*
Blanding's turtle	*Emydoidea blandingi*
Five-lined skink	*Eumeces fasciatus*
Smooth green snake	*Opheodrys vernalis*
Red-bellied snake	*Storeria occipitomaculata*
Common garter snake	*Thamnophis sirtalis*
Birds	
Cooper's hawk	*Accipiter cooperii*
Northern goshawk	*Accipiter gentilis*
Sharp-shinned hawk	*Accipiter striatus*

Table K-1. Plant and Wildlife Species Reported on K. I. Sawyer AFB

Common Name	Scientific Name
Spotted sandpiper[a]	*Actitis macularia*
Northern saw-whet owl	*Aegolius acadicus*
Red-winged blackbird[a]	*Agelaius phoeniceus*
Wood duck	*Aix sponsa*
Blue-winged teal	*Anas discors*
Mallard[a]	*Anas platyrhynchos*
American black duck[a]	*Anas rubripes*
Ruby-throated hummingbird[a]	*Archilochus colubris*
Great blue heron[a]	*Ardea herodias*
Cedar waxwing[a]	*Bombycilla cedrorum*
Ruffed grouse	*Bonasa umbellus*
Canada goose	*Branta canadensis*
Great horned owl	*Bubo virginianus*
Common goldeneye	*Bucephala clangula*
Red-tailed hawk[a]	*Buteo jamaicensis*
Red-shouldered hawk	*Buteo lineatus*
Broad-winged hawk	*Buteo platypterus*
Whip-poor-will	*Caprimulgus vociferus*
Common redpoll	*Carduelis flammea*
Pine siskin	*Carduelis pinus*
American goldfinch[a]	*Carduelis tristis*
Purple finch[a]	*Carpodacus purpureus*
Turkey vulture[a]	*Cathartes aura*
Veery[a]	*Catharus fuscescens*
Hermit thrush[a]	*Catharus guttatus*
Swainson's thrush	*Catharus ustulatus*
Brown creeper[a]	*Certhia americana*
Belted kingfisher[a]	*Ceryle alcyon*
Chimney swift[a]	*Chaetura pelagica*
Killdeer[a]	*Charadrius vociferus*
Black tern	*Chlidonias niger*
Common nighthawk	*Chordeiles minor*
Northern harrier	*Circus cyaneus*
Evening grosbeak	*Coccothraustes vespertinus*
Yellow-billed cuckoo	*Coccyzus americanus*
Black-billed cuckoo	*Coccyzus erythropthalmus*
Northern flicker[a]	*Colaptes auratus*
Rock dove	*Columba livia*
Olive-sided flycatcher	*Contopus borealis*
Eastern wood-pewee[a]	*Contopus virens*

Table K-1. Plant and Wildlife Species Reported on K. I. Sawyer AFB

Common Name	Scientific Name
American crow[a]	*Corvus brachyrhynchos*
Common raven	*Corvus corax*
Blue jay[a]	*Cyanocitta cristata*
Black-throated blue warbler	*Dendroica caerulescens*
Yellow-rumped warbler[a]	*Dendroica coronata*
Chestnut-sided warbler	*Dendroica pensylvanica*
Yellow warbler	*Dendroica petechia*
Black-throated green warbler	*Dendroica virens*
Pileated woodpecker	*Dryocopus pileatus*
Gray catbird	*Dumetella carolinensis*
Least flycatcher	*Empidonax minimus*
Willow flycatcher	*Empidonax traillii*
Horned lark[a]	*Eremophila alpestris*
American kestrel[a]	*Falco sparverius*
American coot[a]	*Fulica americana*
Common snipe	*Gallinago gallinago*
Common loon	*Gavia immer*
Common yellowthroat[a]	*Geothlypis trichas*
Bald eagle	*Haliaeetus leucocephalus*
Cliff swallow[a]	*Hirundo pyrrhonota*
Barn swallow[a]	*Hirundo rustica*
Northern oriole	*Icterus galbula*
Dark-eyed junco	*Junco hyemalis*
Herring gull	*Larus argentatus*
Ring-billed gull	*Larus delawarensis*
Hooded merganser	*Lophodytes cucullatus*
Red crossbill	*Loxia curvirostra*
Song sparrow[a]	*Melospiza melodia*
Common merganser	*Mergus merganser*
Red-breasted merganser	*Mergus serrator*
Black-and-white warbler	*Mniotilta varia*
Brown-headed cowbird[a]	*Molothrus ater*
Great crested flycatcher	*Myiarchus crinitus*
Eastern screech owl	*Otus asio*
Northern parula	*Parula americana*
Black-capped chickadee[a]	*Parus atricapillus*
Boreal chickadee	*Parus hudsonicus*
House sparrow[a]	*Passer domesticus*
Savannah sparrow[a]	*Passerculus sandwichensis*
Indigo bunting[a]	*Passerina cyanea*

Table K-1. Plant and Wildlife Species Reported on K. I. Sawyer AFB

Common Name	Scientific Name
Gray jay	*Perisoreus canadensis*
Rose-breasted grosbeak[a]	*Pheucticus ludovicianus*
Black-backed woodpecker[a]	*Picoides arcticus*
Downy woodpecker	*Picoides pubescens*
Hairy woodpecker[a]	*Picoides villosus*
Scarlet tanager	*Piranga olivacea*
Snow bunting	*Plectrophenax nivalis*
Pied-billed grebe	*Podilymbus podiceps*
Vesper sparrow	*Pooecetes gramineus*
Sora	*Porzana carolina*
Common grackle[a]	*Quiscalus quiscula*
Ruby-crowned kinglet[a]	*Regulus calendula*
Golden-crowned kinglet	*Regulus satrapa*
Eastern phoebe[a]	*Sayornis phoebe*
Ovenbird	*Seiurus aurocapillus*
American redstart[a]	*Setophaga ruticilla*
Red-breated nuthatch	*Sitta canadensis*
White-breasted nuthatch	*Sitta carolinensis*
Yellow-bellied sapsucker	*Sphyrapicus varius*
Chipping sparrow[a]	*Spizella passerina*
Barred owl	*Strix varia*
Eastern meadowlark[a]	*Sturnella magna*
European starling[a]	*Sturnus vulgaris*
Tree swallow[a]	*Tachycineta bicolor*
Brown thrasher[a]	*Toxostoma rufum*
Solitary sandpiper	*Tringa solitaria*
House wren[a]	*Troglodytes aedon*
American robin[a]	*Turdus migratorius*
Sharp-tailed grouse	*Tympanuchus phasianellus*
Eastern kingbird[a]	*Tyrannus tyrannus*
Nashville warbler[a]	*Vermivora ruficapilla*
Warbling vireo[a]	*Vireo gilvus*
Red-eyed vireo[a]	*Vireo olivaceus*
Solitary vireo	*Vireo solitarius*
White-throated sparrow	*Zonotrichia albicollis*
Mammals	
Short-tailed shrew	*Blarina brevicauda*
Coyote[a]	*Canis latrans*
Beaver[a]	*Castor canadensis*

Table K-1. Plant and Wildlife Species Reported on K. I. Sawyer AFB
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Common Name	Scientific Name
Red-backed vole	*Clethrionomys gapperi*
Star-nosed mole	*Condylura cristata*
Big brown bat	*Eptesicus fuscus*
Porcupine[(a)]	*Erethizon dorsatum*
Northern flying squirrel	*Glaucomys sabrinus*
Silver-haired bat	*Lasionycteris noctivagans*
Red bat	*Lasiurus borealis*
Hoary bat	*Lasiurus cinereus*
Snowshoe hare	*Lepus americanus*
European hare	*Lepus europaeus*
River otter	*Lutra canadensis*
Bobcat	*Lynx rufus*
Woodchuck	*Marmota monax*
Common striped skunk[(a)]	*Mephitis mephitis*
Pigmy shrew	*Microsorex hoyi*
Meadow vole	*Microtus pennsylvanicus*
House mouse	*Mus musculus*
Short-tailed weasel	*Mustela erminea*
Long-tailed weasel	*Mustela frenata*
Least weasel	*Mustela nivalis*
Keen's bat	*Myotis keeni*
Little brown bat	*Myotis lucifugus*
White-tailed deer[(a)]	*Odocoileus virginianus*
Muskrat	*Ondatra zibethica*
Deer mouse	*Peromyscus maniculatus*
Raccoon[(a)]	*Procyon lotor*
Norway rat	*Rattus norvegicus*
Arctic shrew	*Sorex arcticus*
Masked shrew	*Sorex cinereus*
Water shrew	*Sorex palustris*
Eastern cottontail[(a)]	*Sylvilagus floridanus*
Eastern chipmunk[(a)]	*Tamias striatus*
Badger	*Taxidea taxus*
Gray fox	*Urocyon cinereoargenteus*
Black bear	*Ursus americanus*
Red fox	*Vulpes vulpes*
Meadow jumping mouse	*Zapus hudsonius*

Notes: (a) Species or species' sign observed in June 1994 field visit.
(b) State species of special concern identified during 1993-1994 Michigan Natural Features Inventory.

Sources: June 1994 field visit; U.S. Air Force, 1992c; U.S. Air Force, 1993d; USFWS, 1993.

Table K-2. Federal or State Sensitive Species Reported in the Proposed Sawmill Timber Procurement Area

Common Name	Scientific Name	Status Federal	Status State
Plants			
Climbing fumitory or Allegheny vine	*Adlumia fungosa*		SC(MI), (WI)
Skinner's gerardia	*Agalinis skinneriana*	C2	T(MI)
Prairie or pale agoseris	*Agoseris glauca*		T(MI)
Bluebunch wheatgrass	*Agropyron spicatum*		X(MI)
Wild chives	*Allium schoenoprasum*		T(MI)
Round-leaved orchis	*Amerorchis rotundifolia*		E(MI), T(WI)
Rosy pussytoes	*Antennaria rosea*		T(MI)
Big-leaf sandwort	*Arenaria macrophylla*		T(MI)
Dragon's mouth	*Arethusa bulbosa*		SC(WI)
Three-awned grass	*Aristida longespica*		T(MI)
Lake cress	*Armoracia lacustris*	C2	T(MI), E(WI)
Heart-leaved arnica	*Arnica cordifolia*		T(MI)
Western mugwort	*Artemisia ludoviciana*		T(MI)
Tall green milkweed	*Asclepias hirtella*		T(MI)
Dwarf milkweed	*Asclepias ovalifolia*		E(MI)
Purple milkweed	*Asclepias purpurascens*		E(WI)
Mountain spleenwort	*Asplenium montanum*		X(MI)
Wall-rue	*Asplenium ruta-muraria*		T(MI)
Maidenhair spleenwort	*Asplenium trichomanes*		SC(WI)
Green spleenwort	*Asplenium viride*		T(MI), E(WI)
Long-leaved aster	*Aster longifolius*		SC(MI)
Great northern aster	*Aster modestus*		T(MI)
Western silvery aster	*Aster sericeus*		T(MI)
Canadian milk-vetch	*Astragalus canadensis*		T(MI)
Cooper's milk-vetch	*Astragalus neglectus*	C2	SC(MI)
Panicled screw-stem	*Bartonia paniculata*		E(MI)
Screwstem	*Bartonia virginica*		SC(WI)
Slough grass	*Beckmannia syzigachne*		T(MI)
Cut-leaved water-parsnip	*Berula erecta*		T(MI)
Acute-leaved moonwort	*Botrychium acuminatum*		T(MI)
Prairie moonwort or dunewort	*Botrychium campestre*		T(MI)
Western moonwort	*Botrychium hesperium*		T(MI)
Mingan's moonwort	*Botrychium minganense*		SC(WI)
Goblin moonwort	*Botrychium mormo*	C2	SC(MI), E(WI)
Blunt-lobed grape fern	*Botrychium oneidense*		SC(WI)
Ternate grape fern	*Botrychium rugulosum*		SC(WI)

Table K-2. Federal or State Sensitive Species Reported in the Proposed Sawmill Timber Procurement Area
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Common Name	Scientific Name	Status Federal	Status State
Side-oats grama grass	*Bouteloua curtipendula*		T(MI)
Low northern rock-cress	*Braya humilis*		T(MI)
Pumpelly's brome grass	*Bromus pumpellianus*		T(MI)
Prairie Indian-plantain	*Cacalia plantaginea*		T(MI)
Sea rocket	*Cakile edentula*		SC(WI)
Bog reed grass	*Calamagrostis inexpansa*		SC(WI)
Northern reedgrass	*Calamagrostis lacustris*		T(MI)
Narrow-leaved reedgrass	*Calamagrostis stricta*		T(MI)
Autumnal water-starwort	*Callitriche hermaphroditica*		SC(MI), (WI)
Large water-starwort	*Callitriche heterophylla*		T(SC)
Calypso or fairy-slipper	*Calypso bulbosa*		T(MI), (WI)
Walking fern	*Camptosorus rhizophyllus*		T(MI)
Cuckoo flower	*Cardamine pratensis* var. *palustris*		SC(WI)
Greenish-white sedge	*Carex albolutescens*		SC(MI)
Sedge	*Carex arcta*		SC(MI)
Assiniboia sedge	*Carex assiniboinensis*		T(MI), (WI)
Sedge	*Carex atratiformis*		T(MI)
Rocky mountain sedge	*Carex backii*		SC(WI)
Beauty sedge	*Carex concinna*		SC(MI)
Crawe sedge	*Carex crawei*		SC(WI)
Davis's sedge	*Carex davisii*		SC(MI)
Frank's sedge	*Carex frankii*		SC(MI)
Northern bog sedge	*Carex gynocrates*		SC(MI)
Hayden's sedge	*Carex haydenii*		SC(MI)
Hudson Bay sedge	*Carex heleonastes*		E(MI)
Shore sedge	*Carex lenticularis*		T(WI)
Livid sedge	*Carex livida* var. *radicaulis*		SC(WI)
Sedge	*Carex media*		T(MI)
Black sedge	*Carex nigra*		E(MI)
New England sedge	*Carex novae-angliae*		T(MI)
Pale sedge	*Carex pallescens*		SC(MI)
Pale sedge	*Carex pallescens* var. *neogaea*		SC(WI)
Broad-leaved sedge	*Carex platyphylla*		T(MI)
Richardson's sedge	*Carex richardsonii*		SC(MI)
Ross's sedge	*Carex rossii*		T(MI)
Bulrush sedge	*Carex scirpoidea*		T(MI)
Sedge	*Carex seorsa*		T(MI)
Sedge	*Carex squarrosa*		SC(MI)

Table K-2. Federal or State Sensitive Species Reported in the Proposed Sawmill Timber Procurement Area
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Common Name	Scientific Name	Status	
		Federal	State
Many-headed sedge	*Carex sychnocephala*		SC(WI)
Sparse-flowered sedge	*Carex tenuiflora*		SC(WI)
Sheathed sedge	*Carex vaginata*		SC(WI)
Wiegand's sedge	*Carex wiegandii*		T(MI)
Pale Indian paintbrush	*Castilleja septentrionalis*		T(MI)
Redstem ceanothus or wild lilac	*Ceanothus sanguineus*		T(MI)
Keweenaw rock-rose	*Chamaerhodos nuttallii* var. *keweenawensis*	C2	E(MI)
Flodman's thistle	*Cirsium flodmanii*		SC(WI)
Hill's thistle	*Cirsium hillii*	C2	SC(MI), T(WI)
Pitcher's thistle	*Cirsium pitcheri*	LT	T(MI)
Purple clematis	*Clematis occidentalis*		SC(MI)
Small blue-eyed mary	*Collinsia parviflora*		T(MI)
Douglas's hawthorn	*Crataegus douglasii*		SC(MI)
English sundew	*Crosera anglica*		SC(MI)
American rock-brake	*Cryptogramma acrostichoides*		T(MI)
Slender cliff-brake	*Cryptogramma stelleri*		SC(MI)
Ram's head lady's-slipper	*Cypripedium arietinum*	3C	SC(MI), T(WI)
Small yellow lady's-slipper	*Cypripedium parviflorum*		SC(WI)
Showy lady's-slipper	*Cypripedium reginae*		SC(WI)
Laurentian fragile fern	*Cystopteris laurentiana*		SC(MI)
False-violet	*Dalibarda repens*		T(MI)
Flat oat grass	*Danthonia compressa*		T(MI)
Wild oat-grass	*Danthonia intermedia*		SC(MI)
Large toothwort	*Dentaria maxima*		T(MI)
Common hairgrass	*Deschampsia flexuosa*		SC(WI)
Beak grass	*Diarrhena americana*		T(MI)
Fairy bells	*Disporum hookeri*		E(MI)
Shooting-star	*Dodecatheon meadia*		T(MI)
Rock whitlow-grass	*Draba arabisans*		T(MI)
Ashy whitlow-grass	*Draba cana*		T(MI)
Smooth whitlow-grass	*Draba glabella*		T(MI)
Twisted whitlow-grass	*Draba incana*		T(MI)
English sundew	*Drosera anglica*		SC(MI)
Linear-leaved sundew	*Drosera linearis*		T(WI)
Clinton wood fern	*Dryopteris clintoniana*		SC(WI)
Expanded woodfern	*Dryopteris expansa*		SC(MI), (WI)
Male fern	*Dryopteris filix-mas*		T(MI), SC(WI)
Fragrant cliff woodfern	*Dryopteris fragrans*		SC(MI)

Table K-2. Federal or State Sensitive Species Reported in the Proposed Sawmill Timber Procurement Area

Common Name	Scientific Name	Status	
		Federal	State
Fragrant fern	*Dryopteris fragrans remotiuscula*		SC(WI)
Flattened spike-rush	*Eleocharis compressa*		T(MI)
Engelmann's spike-rush	*Eleocharis engelmannii*		SC(MI)
Black-fruited spike-rush	*Eleocharis melanocarpa*		SC(MI)
Slender spike-rush	*Eleocharis nitida*		E(MI)
Capitate spike-rush	*Eleocharis olivacea*		SC(WI)
Angle-stemmed spike-rush	*Eleocharis quadrangulata*		E(WI)
Few-flowered spike-rush	*Eleocharis quinqueflora*		SC(WI)
Robbins spike-rush	*Eleocharis robbinsii*		SC(WI)
Three-ribbed spike-rush	*Eleocharis tricostata*		T(MI)
Blue wild-rye	*Elymus glaucus*		SC(MI)
American dune wild-rye	*Elymus mollis*		SC(MI)
Black crowberry	*Empetrum nigrum*		T(MI)
Marsh willow-herb	*Epilobium palustre*		SC(MI), (WI)
Giant horsetail	*Equisetum telmateia*		X(MI)
Variegated scouring rush	*Equisetum variegatum*		SC(WI)
Small love grass	*Eragrostis pilosa*		SC(MI)
Hyssop-leaved fleabane	*Erigeron hyssopifolius*		T(MI)
American eyebright	*Euphrasia arctica*		T(MI)
Rough fescue	*Festuca scabrella*		T(MI)
Narrow-leaved gentian	*Gentiana linearis*		T(MI)
Prairie-smoke	*Geum triflorum*		T(MI)
Wild licorice	*Glycyrrhiza lepidota*		SC(WI)
Hedge-hyssop	*Gratiola lutea*		T(MI)
Northern oak fern	*Gymnocarpium jessoense*		E(MI)
Limestone oak fern	*Gymnocarpium robertianum*		SC(MI)
Alpine sainfoin	*Hedysarum alpinum*		E(MI)
Whiskered sunflower	*Helianthus hirsutus*		SC(MI)
Dwarf-bulrush	*Hemicarpha micrantha*		SC(MI)
Gentian-leaved St. John's-wort	*Hypericum gentianoides*		SC(MI)
Dwarf lake iris	*Iris lacustris*	LT	T(MI)
Whorled pogonia	*Isotria verticillata*		T(MI)
Twin leaf	*Jeffersonia diphylla*		SC(MI)
Two-flowered rush	*Juncus biflorus*		SC(MI)
Short-fruited rush	*Juncus brachycarpus*		T(MI)
Bayonet rush	*Juncus militaris*		T(MI)

Table K-2. Federal or State Sensitive Species Reported in the Proposed Sawmill Timber Procurement Area
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Common Name	Scientific Name	Status	
		Federal	State
Bog rush	*Juncus stygius*		T(MI), E(WI)
Vasey's rush	*Juncus vaseyi*		T(MI), SC(WI)
False boneset	*Kuhnia eupatorioides*		SC(MI)
Blue lettuce	*Lactuca pulchella*		T(MI)
Least pinweed	*Lechea minor*		SC(MI)
Erect pinweed	*Lechea stricta*		SC(MI)
White ground cherry	*Leucophysalis grandiflora*		SC(WI)
Furrowed flax	*Linum sulcatum*		SC(MI)
Auricled twayblade	*Listera auriculata*	3C	SC(MI)
Broad-leaved twayblade	*Listera convallarioides*		T(WI)
Broad-leaved puccoon	*Lithospermum latifolium*		SC(MI)
American shore-grass	*Littorella americana*		SC(MI), (WI)
Black twinberry	*Lonicera involucrata*		T(MI)
Small-flowered woodrush	*Luaula parviflora*		T(MI)
Clubmoss	*Lycopodium appressum*		T(MI)
Savin-leaved clubmoss	*Lycopodium sabinifolium*		E(MI)
Fir clubmoss	*Lycopodium selago*		SC(MI)
White adder's-mouth	*Malaxis brachypoda*		SC(WI)
Indian cucumber root	*Medeola virginiana*		SC(WI)
Virginia bluebells	*Mertensia virginica*		T(MI)
James' monkey-flower	*Mimulus glabratus* var. *jamesii*		SC(MI)
Michigan monkey-flower	*Mimulus glaratus* var. *michiganensis*	LE	E(MI)
Western monkey-flower	*Mimulus guttatus*		SC(MI)
Large-leaved sandwort	*Moehringia macrophylla*		E(WI)
Plains muhly	*Muhlenbergia cuspidata*		X(MI)
Mat muhly	*Muhlenbergia richardsonis*		T(MI)
Alternate-leaved water-milfoil	*Myriophyllum alterniflorum*		SC(MI)
Farwell's water-milfoil	*Myriophyllum farwellii*		T(MI), SC(WI)
Small yellow pond-lily	*Nuphar pumila*		T(MI)
Pygmy water-lily	*Nymphaea tetragona*		T(MI)
Adder's-tongue	*Ophioglossum vulgatum*		SC(WI)
Devil's-club	*Oplopanax horridus*		T(MI)
Fragile prickly-pear	*Opuntia fragilis*		E(MI)
Fascicled broom-rape	*Orobanche fasciculata*		T(MI)
Canada rice-grass	*Oryzopsis canadensis*		T(MI), SC(WI)
Sweet cicely	*Osmorhiza depauperata*		SC(MI)
Ginseng	*Panax quinquefolius*	3C	T(MI), SC(WI)
Small-fruited panic-grass	*Panicum microcarpon*		SC(MI)

Table K-2. Federal or State Sensitive Species Reported in the Proposed Sawmill Timber Procurement Area

Common Name	Scientific Name	Status: Federal	Status: State
Marsh grass-of-parnassus	*Parnassia palustris*		T(MI)
Purple cliff-brake	*Pellaea atropurpurea*		T(MI)
Slender beard-tongue	*Penstemon gracilis*		E(MI)
Hairy beardtongue	*Penstemon hirsutus*		SC(WI)
Pale beardtongue	*Penstemon pallidus*		SC(WI)
Sweet coltsfoot	*Petasites sagittatus*		T(MI)
Franklin's phacelia	*Phacelia franklinii*		T(MI)
Broad beech fern	*Phegopteris hexagonoptera*		SC(WI)
Mountain timothy	*Phleum alpinum*		X(MI)
Hart's-tongue fern	*Phyllitis scolopendrium* var. *americana*	LT	E(MI)
Butterwort	*Pinguicula vulgaris*		SC(MI)
Alaska orchid	*Piperia unalascensis*		SC(MI)
Orange or yellow fringed orchid	*Platanthera ciliaris*		T(MI)
White bog orchid	*Platanthera dilatata*		SC(WI)
Tubercled orchid	*Platanthera flava* var. *herbiola*		T(WI)
Hooker's orchid	*Platanthera hookeri*		SC(WI)
Prairie fringed orchid	*Platanthera leucophaea*	LT	E(MI)
Round-leaved orchid	*Platanthera orbiculata*		SC(WI)
Alpine bluegrass	*Poa alpina*		T(MI)
Canby's bluegrass	*Poa canbyi*		T(MI)
Bog bluegrass	*Poa paludigena*	C2	T(MI)
Western jacob's ladder	*Polemonium occidentale lacustre*	C	SC(WI)
Cross-leaved milkwort	*Polygala cruciata*		SC(MI)
Carey's smartweed	*Polygonum careyi*		T(MI)
Alpine bistort	*Polygonum viviparum*		T(MI)
Large-flowered leafcup	*Polymnia uvedalia*		T(MI)
Braun's holly fern	*Polystichum braunii*		T(WI)
Brown walker	*Pomatiopsis cincinnatiensis*		SC(MI)
Waterthread pondweed	*Potamogeton bicupulatus*		T(MI)
Alga pondweed	*Potamogeton confervoides*	C2	T(MI), (WI)
Hill's pondweed	*Potamogeton hillii*	3C	T(MI)
Spotted pondweed	*Potamogeton pulcher*		T(MI), E(WI)
Sheathed pondweed	*Potamogeton vaginatus*		T(WI)
Vasey's pondweed	*Potamogeton vaseyi*		SC(WI)
Prairie cinquefoil	*Potentilla pensylvanica*		T(MI)
Bird's-eye primrose	*Primula mistassinica*		SC(WI)
Sloe plum	*Prunus alleghaniensis*	C2	SC(MI)

Table K-2. Federal or State Sensitive Species Reported in the Proposed Sawmill Timber Procurement Area
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Common Name	Scientific Name	Status: Federal	Status: State
Alleghany or sloe plum	*Prunus alleghaniensis* var. *davisii*	C2	SC(MI)
Bald-rush	*Psilocarya scirpoides*		T(MI)
Pine-drops	*Pterospora andromedea*		T(MI)
Hairy mountain-mint	*Pycnanthemum pilosum*		SC(MI)
Small shinleaf	*Pyrola minor*		E(WI)
Seaside crowfoot	*Ranunculus cymbalaria*		T(MI)
Small yellow water crowfoot	*Ranunculus gmelinii* var. *hookeri*		E(WI)
Lapland buttercup	*Ranunculus lapponicus*		T(MI)
Macoun's buttercup	*Ranunculus macounii*		T(MI)
Prairie buttercup	*Ranunculus rhomboideus*		T(MI)
Meadow-beauty	*Rhexia virginica*		SC(MI)
Sooty beakrush	*Rhynchospora fusca*		SC(WI)
Tall beak-rush	*Rhynchospora macrostachya*		SC(MI)
Canadian black currant	*Ribes hundsonianum*		SC(WI)
Northern gooseberry	*Ribes oxyacanthoides*		SC(MI)
Tooth-cup	*Rotala ramosior*		SC(MI)
Dwarf raspberry	*Rubus acaulis*		T(MI)
Showy coneflower	*Rudbeckia sullivantii*		SC(MI)
Widgeon-grass	*Ruppia maritima*		T(MI)
Pearlwort	*Sagina nodosa*		T(MI)
Satiny willow	*Salix pellita*		SC(MI)
Tea-leaved willow	*Salix planifolia*		T(MI)
Silky willow	*Salix sericea*		SC(WI)
Yellow pitcher-plant	*Sarracenia purpurea* ssp *heterophylla*		T(MI)
Encrusted saxifrage	*Saxifraga paniculata*		T(MI)
Prickly saxifrage	*Saxifraga tricuspidata*		T(MI)
Tussock bulrush	*Scirpus cespitosus* var. *callosus*		E(WI)
Clinton's bulrush	*Scirpus clintonii*		T(MI)
Pale bulrush	*Scirpus pallidus*		SC(WI)
Torrey's bulrush	*Scirpus torreyi*		SC(MI)
Small skullcap	*Scutellaria parvula*		T(MI)
Marsh-fleabane	*Senecio congestus*		X(MI), SC(WI)
Rayless mountain ragwort	*Senecio indecorus*		T(MI), SC(WI)
Fire pink	*Silene virginica*		T(MI)
Compass-plant	*Silphium laciniatum*		T(MI)
Blue-eyed-grass	*Sisyrinchium strictum*		SC(MI)

Table K-2. Federal or State Sensitive Species Reported in the Proposed Sawmill Timber Procurement Area
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Common Name	Scientific Name	Status: Federal	Status: State
Reclining goldenrod	*Solidago decumbens*		SC(MI)
Houghton's goldenrod	*Solidago houghtonii*	LT	T(MI)
Western goldenrod	*Solidago lepida*		SC(MI)
Yellow ladies'-tresses	*Spiranthes ochroleuca*		SC(MI)
Prairie dropseed	*Sporobolus heterolepis*		T(MI)
Fleshy stitchwort	*Stellaria crassifolia*		T(MI)
Stitchwort	*Stellaria longipes*		SC(MI)
Awlwort	*Subularia aquatica*		T(MI)
Lake Huron tansy	*Tanacetum huronense*		T(MI)
Waxy meadow-rue	*Thalictrum revolutum*		T(MI)
Veiny meadow-rue	*Thalictrum venolosum varconfine*		T(MI)
Foamflower	*Tiarella cordifolia*		E(WI)
False asphodel	*Tofieldia pusilla*		T(MI)
Virginia spiderwort	*Tradescantia virginiana*		SC(MI)
False pennyroyal	*Trichostema brachiatum*		T(MI)
Common bog arrow-grass	*Triglochin maritimum*		SC(WI)
Slender bog arrow-grass	*Triglochin palustre*		SC(WI)
Three-birds orchid	*Triphora trianthophora*		T(MI)
Downy oat-grass	*Trisetum spicatum*		SC(MI)
Twin-stemmed bladderwort	*Utricularia geminiscapa*		SC(WI)
Purple bladderwort	*Utricularia purpurea*		SC(WI)
Small purple bladderwort	*Utricularia resupinata*		SC(WI)
Dwarf bilberry	*Vaccinium cespitosum*		T(MI), E(WI)
Alpine blueberry	*Vaccinium uliginosum*		T(MI)
Mountain-cranberry	*Vaccinium vitis-idaea*		X(MI)
Marsh valerian	*Valeriana sitchenesis* ssp *uliginosa*		T(WI)
Withe rod	*Viburnum cassinoides*		SC(WI)
Squashberry or mooseberry	*Viburnum edule*		T(MI)
Northern marsh violet	*Viola epipsila*		T(MI)
New England violet	*Viola novae-angliae*	C2	T(MI), (WI)
Prairie birdfoot violet	*Viola pedatifida*		T(MI)
Northern woodsia	*Woodsia alpina*		T(MI)
Blunt-lobed woodsia	*Woodsia obtusa*		T(MI)
Wild-rice	*Zizania aquatica* var. *aquatica*		T(MI)
Prairie golden alexanders	*Zizia aptera*		T(MI)

Table K-2. Federal or State Sensitive Species Reported in the Proposed Sawmill Timber Procurement Area
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Common Name	Scientific Name	Status Federal	Status State
Animals			
Cooper's hawk	*Accipiter cooperii*		R(WI)
Lake sturgeon	*Acipenser fulvescens*	C2	T(MI), R(WI)
Blanchard's cricket frog	*Acris crepitans blanchardi*		SC(MI)
Mottled darner	*Aeshna clepsydra*		SC(WI)
Lake darner	*Aeshna eremita*		SC(WI)
Black-tipped darner	*Asehna tuberculifera*		SC(WI)
Elktoe	*Alasmidonta marginata*		R(WI)
Slippershell	*Alasmidonta viridis*		T(WI)
Moose	*Alces alces*		SC(MI)
American eel	*Anguilla rostrata*		SC(WI)
Pirate perch	*Aphredoderus sayanus*		SC(WI)
Secretive locust	*Appalachia arcana*	C2	SC(MI)
Missouri rock cress	*Arabis missouriensis* var. *deamii*	C	SC(WI)
Short-eared owl	*Asio flammeus*		E(MI)
Dusted skipper	*Atrytonopsis hianna*		T(MI)
Upland sandpiper	*Bartramia longicauda*		R(WI)
Bog fritillary	*Boloria eunomia*		SC(WI)
Freija fritillary	*Boloria freija*		SC(WI)
Frigga fritillary	*Boloria frigga*		SC(WI)
Boreal brachionyncha	*Brachionycha borealis*		SC(MI)
Hungerford's crawling water beetle	*Brychius hungerfordi*	LE	E(MI)
Red-shouldered hawk	*Buteo lineatus*		T(MI), T(WI)
Swamp metalmark	*Calephelis mutica*		T(WI)
Gray wolf	*Canis lupus*	LELT	E(MI), (WI)
Great egret	*Casmerodius albus*		T(WI)
Piping plover	*Charadrius meoldus*	LELT	E(MI), (WI)
Black tern	*Chlidonias niger*	C	R(WI)
Northern harrier	*Circus cyaneus*		SC(MI)
Spotted turtle	*Clemmys guttata*		SC(MI)
Wood turtle	*Clemmys insculpta*		SC(MI), (WI)
Redside dace	*Clinostomus elongatus*		SC(WI)
Subarctic bluet	*Coenagrion interrogatum*		SC(WI)
Inornate ringlet	*Coenonympha tullia*		SC(WI)
Delta-spotted spiketail	*Cordulegaster diastatops*		SC(WI)
Arrowhead spiketail	*Cordulegaster obliqua*		SC(WI)
Lake herring	*Coregonus artedi*		R(WI)
Siskiwit lake cisco	*Coregonus bartlettii*		SC(MI)

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Common Name	Scientific Name	Status: Federal	Status: State
Bloater	*Coregonus hoyi*		R(WI)
Ives lake cisco	*Coregonus hubbsi*		SC(MI)
Yellow rail	*Coturnicops noveboracensis*		T(MI), R(WI)
Cerulean warbler	*Dendroica cerulea*	C	T(WI)
Kirtland's warbler	*Dendroica kirtlandii*	LE	E(MI)
Snuffbox mussel	*Dysnomia triquetra*	C2	E(MI)
Eastern fox snake	*Elaphe vulpina gloydi*		T(MI)
Atlantic elliptio	*Elliptio complanata*		R(WI)
Blanding's turtle	*Emydoidea blandingii*	C	T(WI)
Snuffbox mussel	*Epioblasma triquetra*	C	E(WI)
Red-disked alpine	*Erebia discoidalis*		SC(MI), (WI)
Lake chubsucker	*Erimyzon sucetta*		SC(WI)
Early hairstreak	*Erora laeta*		SC(MI)
Persius dusky wing	*Erynnis persius persius*		SC(WI)
Least darter	*Etheostoma microperca*		SC(WI)
Banded darter	*Etheostoma zonale*		SC(MI)
Dion skipper	*Euphyes dion*		SC(WI)
Merlin	*Falco columbarius*		T(MI)
Peregrine falcon	*Falco peregrinus*	E/SA	E(MI)
American peregrine falcon	*Falco peregrinus anatum*	E	E(WI)
Lynx	*Felis lynx*	C2	E(MI)
Harvester	*Feniseca tarquinius*		SC(WI)
Watercress snail	*Fontigens nickliniana*		SC(MI)
Common moorhen	*Gallinula chloropus*		SC(MI)
Common loon	*Gavia immer*		T(MI)
White-lined clubtail	*Gomphus lineatifrons*		SC(MI), (WI)
Four-colored clubtail	*Gomphus quadricolor*		SC(MI), (WI)
Midland clubtail	*Gomphurus fraternus*		SC(WI)
Skillet clubtail	*Gomphurus ventricosus*		SC(WI)
Bald eagle	*Haliaeetus leucocephalus*	T	T(MI), (WI)
Cherrystone drop	*Hendersonia occulta*		T(MI)
Ottoe skipper	*Hesperia ottoe*		T(MI)
Green-faced clubtail	*Hylogomphus viridifrons*		SC(WI)
Henry's elfin	*Incisalia henrici*		SC(MI)
Frosted elfin	*Incisalia irus*		T(MI)
Citrine forktail	*Ischnura hastata*		SC(WI)
Loggerhead shrike	*Lanius ludovicianus*	C	E(WI)
Loggerhead shrike	*Lanius ludovicianus migrans*	C2	E(MI)
Great Plains spittlebug	*Lepyronia gibbosa*		T(MI)

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Common Name	Scientific Name	Status Federal	Status State
Amber-winged spreadwing	*Lestes eurinus*		SC(WI)
Swamp spreadwing	*Lestes vigilax*		SC(WI)
Longear sunfish	*Lepomis megalotis*		T(WI)
Slaty skimmer	*Libellula incesta*		SC(WI)
Northern blue butterfly	*Lycaeides idas nabokovi*		T(MI), E(WI)
Karner blue butterfly	*Lycaeides melissa samuelis*	LE	T(MI), SC(WI)
Dorcas copper	*Lycaena dorcas*		SC(WI)
Bog copper	*Lycaena epixanthe*		SC(WI)
Lynx	*Lynx canadensis*	C	E(WI)
Redfin shiner	*Lythrurus umbratilis*		T(WI)
Pine marten	*Martes americana*		T(MI), E(WI)
Doll's merolonche	*Merolonche dolli*		SC(MI)
Spike-lipped crater	*Mesodon sayanus*		SC(MI)
Woodland vole	*Microtus pinetorum*		SC(MI)
River redhorse	*Moxostoma carinatum*		T(MI), (WI)
Greater redhorse	*Moxostoma valenciennesi*		T(WI)
Elfin skimmer	*Nannothemis bella*		SC(WI)
Cyrano darner	*Nasiaeschna pentacantha*		SC(WI)
Stygian shadowfly	*Neurocordulia yamaskanensis*		SC(WI)
American burying beetle	*Nicrophorus americanus*	LE	E(MI), (WI)
Pugnose shiner	*Notropis anogenus*		SC(MI), T(WI)
Weed shiner	*Notropis texanus*		E(MI), SC(WI)
Slender madtom	*Noturus exilis*		E(WI)
Black-crowned night-heron	*Nycticorax nycticorax*		SC(MI), R(WI)
Jutta arctic	*Oeneis jutta ascerta*		SC(WI)
3-striped oncocnemis	*Oncocnemis piffardi*		SC(MI)
Extra-striped snaketail	*Ophiogomphus anomalus*	C	E(WI)
Riffle snaketail	*Ophiogomphus carolus*		SC(WI)
Pygmy snaketail	*Ophiogomphus howei*	C	E(WI)
Pugnose minnow	*Opsopoeodus emiliae*		SC(WI)
Three-horned moth	*Pachypolia atricornis*		SC(MI)
Osprey	*Pandion haliaetus*		T(MI), (WI)
Aweme borer	*Papaipema aweme*	C2	SC(MI)
Blazing star borer	*Papaipema beeriana*		SC(MI)
Culvers root borer	*Papaipema sciata*		SC(MI)
Channel darter	*Percina copelandi*		T(MI)
River darter	*Percina shumardi*		E(MI)
Double-crested cormorant	*Phalacrocorax auritus*		R(WI)
Tawny crescent spot	*Phyciodes batesii*	C	SC(WI)

Table K-2. Federal or State Sensitive Species Reported in the Proposed Sawmill Timber Procurement Area
Page 12 of 13

Common Name	Scientific Name	Status: Federal	Status: State
Black-backed woodpecker	*Picoides arcticus*		SC(MI)
West Virginia white	*Pieris virginiensis*		SC(WI)
Eastern flat-whorl	*Planogyra asteriscus*		SC(MI)
Acorn rams-horn	*Planorbella multivolvis*	C2	E(MI)
Round pigtoe	*Pleurobema sintoxia*		R(WI)
Mulberry wing	*Poanes massasoit*		SC(WI)
Broad-winged skipper	*Poanes viator*		SC(WI)
Red-necked grebe	*Podiceps grisegena*		E(WI)
Paddlefish	*Polyodon spathula*	C	T(WI)
Red-legged spittlebug	*Prosapia ignipectus*		SC(MI)
	Prunus alleghaniensis	3C	
Boreal chorus frog	*Pseudacris triseriata maculata*		SC(MI)
Sprague's pygarctia	*Pygarctia spraguei*		SC(MI)
Grizzled skipper	*Pyrgus wyandot*	C2	SC(MI)
King rail	*Rallus elegans*		E(MI), R(WI)
Pickerel frog	*Rana palustris*		SC(WI)
Smokey eyed brown	*Satyrodes eurydice fumosa*		SC(WI)
Phlox moth	*Schinia indiana*	C2	E(MI), (WI)
Salamander mussel	*Simpsoniconcha ambigua*	C2	E(MI), T(WI)
Massasauga	*Sistrurus catenatus catenatus*	C2	SC(MI)
Ski-tailed emerald	*Somatochlora elongata*		SC(WI)
Forcipate emerald	*Somatochlora forcipata*		SC(WI)
Delicate emerald	*Somatochlora franklini*		SC(WI)
Warpaint emerald	*Somatochlora incurvata*		SC(MI)
Kennedy's emerald	*Somatochlora kennedyi*		SC(WI)
Smokey shrew	*Sorex fumeus*		SC(MI)
Spartina moth	*Spartiniphaga inops*		SC(MI)
Regal fritillary	*Speyeria idalia*	C2	E(MI)
Deepwater pondsnail	*Stagnicola contractus*		T(MI)
Douglas stenelmis riffle beetle	*Stenelmis douglasensis*	C2	SC(MI)
Caspian tern	*Sterna caspia*		T(MI)
Forster's tern	*Sterna forsteri*		SC(MI), E(WI)
Common tern	*Sterna hirundo*	C2NL, T	T(MI), E(WI)
Least clubtail	*Stylogomphus albistylus*		SC(WI)
Amnicola snaketail	*Stylurus amnicola*		SC(MI)
Zebra clubtail	*Stylurus scudderi*		SC(WI)
Black meadowhawk	*Sympetrum danae*		SC(WI)
Eastern box turtle	*Terrapene carolina carolina*		SC(MI)
Western ribbon snake	*Thamnophis proximus*		E(WI)

Table K-2. Federal or State Sensitive Species Reported in the Proposed Sawmill Timber Procurement Area
Page 13 of 13

Common Name	Scientific Name	Status Federal	Status State
Northern ribbon snake	*Thamnophis sauritus*		E(WI)
Lake Huron locust	*Trimerotropis huroniana*	C2	T(MI)
Buckhorn	*Tritogonia verrucosa*		T(WI)
Greater prairie-chicken	*Tympanuchus cupido*		T(WI)
Barn owl	*Tyto alba*		E(WI)
Canadian bog skimmer	*Williamsonia fletcheri*		SC(MI)
Ebony bog haunter	*Williamsonia fletcheri*		SC(WI)
Yellow-headed blackbird	*Xanthocephalus xanthocephalus*		SC(MI)

C = Candidate for federal listing
C2 = Endangered or threatened status may be more appropriate, but more information is needed
C2NL,T = Threatened in part of its range, C2 in part of its range, not listed in the rest of its range
E = Endangered
E/SA = Endangered; eastern subspecies, which is similar in appearance, is also listed as endangered
LE = Endangered in part of its range
LELT = Endangered in part of its range and threatened in the rest of its range
LT = Threatened in part of its range
MI = Michigan
R = Rare
SC = Special Concern (rare, may become endangered or threatened in the future)
T = Threatened
3C = Not currently being considered for listing
WI = Wisconsin
X = Probably extirpated

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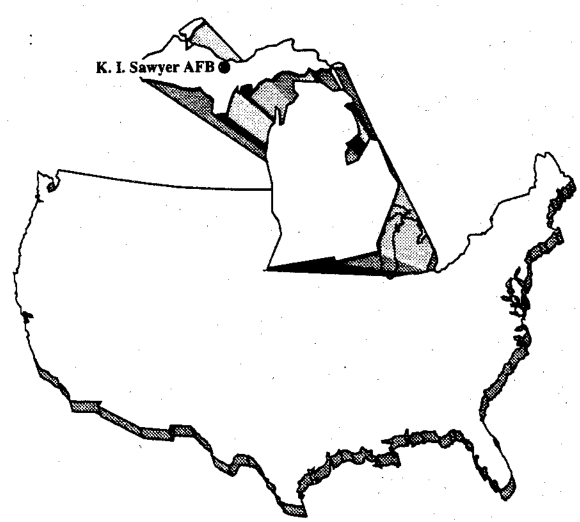

APPENDIX L

APPENDIX L

FARMLAND CONVERSION IMPACT RATING
FORM AD-1006

United States Department of Agriculture

Soil Conservation Service

May 23, 1994

Ted Shierk
HQ AFCEE/EC
8106 Chennault Road
Brooks AFB, TX 78235-5318

Dear Mr. Shierk,

The four alternatives being analyzed at K.I. Sawyer AFB, MI will not affect prime, unique, statewide, or local important farmland.

Sincerely,

Michael J. LaPointe, District Conservationist
Ph: 906-226-9460

The Soil Conservation Service is an agency of the Department of Agriculture

U.S. Department of Agriculture

FARMLAND CONVERSION IMPACT RATING

PART I *(To be completed by Federal Agency)*	Date Of Land Evaluation Request 03 May 1994
Name Of Project K. I. Sawyer AFB Disposal and Reuse	Federal Agency Involved USAF, FAA
Proposed Land Use Airfield Aviation, Mixed Use	County And State Marquette, Michigan
PART II *(To be completed by SCS)*	Date Request Received By SCS

Does the site contain prime, unique, statewide or local important farmland? *(If no, the FPPA does not apply — do not complete additional parts of this form).*	Yes ☐ No ☐	Acres Irrigated	Average Farm Size
Major Crop*(s)*	Farmable Land In Govt. Jurisdiction Acres: %		Amount Of Farmland As Defined in FPPA Acres: %
Name Of Land Evaluation System Used	Name Of Local Site Assessment System		Date Land Evaluation Returned By SCS

	Maximum Points	Alternative Site Rating Site A	Site B	Site C	Site D
PART III *(To be completed by Federal Agency)*					
A. Total Acres To Be Converted Directly *		3,828	3,122	4,923	4,923
B. Total Acres To Be Converted Indirectly		Ø	Ø	Ø	Ø
C. Total Acres In Site		4,923	4,923	4,923	4,923
PART IV *(To be completed by SCS)* Land Evaluation Information					
A. Total Acres Prime And Unique Farmland					
B. Total Acres Statewide And Local Important Farmland					
C. Percentage Of Farmland In County Or Local Govt. Unit To Be Converted					
D. Percentage Of Farmland In Govt. Jurisdiction With Same Or Higher Relative Value					
PART V *(To be completed by SCS)* Land Evaluation Criterion Relative Value Of Farmland To Be Converted *(Scale of 0 to 100 Points)*					
PART VI *(To be completed by Federal Agency)* Site Assessment Criteria *(These criteria are explained in 7 CFR 658.5(b))*	Maximum Points				
1. Area In Nonurban Use					
2. Perimeter In Nonurban Use					
3. Percent Of Site Being Farmed					
4. Protection Provided By State And Local Government					
5. Distance From Urban Builtup Area					
6. Distance To Urban Support Services					
7. Size Of Present Farm Unit Compared To Average					
8. Creation Of Nonfarmable Farmland					
9. Availability Of Farm Support Services					
10. On-Farm Investments					
11. Effects Of Conversion On Farm Support Services					
12. Compatibility With Existing Agricultural Use					
TOTAL SITE ASSESSMENT POINTS	160				
PART VII *(To be completed by Federal Agency)*					
Relative Value Of Farmland *(From Part V)*	100				
Total Site Assessment *(From Part VI above or a local site assessment)*	160				
TOTAL POINTS *(Total of above 2 lines)*	260				

Site Selected:	Date Of Selection	Was A Local Site Assessment Used? Yes ☐ No ☐

Reason For Selection:

*** Not available for agriculture**

L-2

STEPS IN THE PROCESSING THE FARMLAND AND CONVERSION IMPACT RATING FORM

Step 1 – Federal agencies involved in proposed projects that may convert farmland, as defined in the Farmland Protection Policy Act (FPPA) to nonagricultural uses, will initially complete Parts I and III of the form.

Step 2 – Originator will send copies A, B and C together with maps indicating locations of site(s), to the Soil Conservation Service (SCS) local field office and retain copy D for their files. (Note: SCS has a field office in most counties in the U.S. The field office is usually located in the county seat. A list of field office locations are available from the SCS State Conservationist in each state).

Step 3 – SCS will, within 45 calendar days after receipt of form, make a determination as to whether the site(s) of the proposed project contains prime, unique, statewide or local important farmland.

Step 4 – In cases where farmland covered by the FPPA will be converted by the proposed project, SCS field offices will complete Parts II, IV and V of the form.

Step 5 – SCS will return copy A and B of the form to the Federal agency involved in the project. (Copy C will be retained for SCS records).

Step 6 – The Federal agency involved in the proposed project will complete Parts VI and VII of the form.

Step 7 – The Federal agency involved in the proposed project will make a determination as to whether the proposed conversion is consistent with the FPPA and the agency's internal policies.

INSTRUCTIONS FOR COMPLETING THE FARMLAND CONVERSION IMPACT RATING FORM

Part I: In completing the "County And State" questions list all the local governments that are responsible for local land controls where site(s) are to be evaluated.

Part III: In completing item B (Total Acres To Be Converted Indirectly), include the following:

1. Acres not being directly converted but that would no longer be capable of being farmed after the conversion, because the conversion would restrict access to them.

2. Acres planned to receive services from an infrastructure project as indicated in the project justification (e.g. highways, utilities) that will cause a direct conversion.

Part VI: Do not complete Part VI if a local site assessment is used.

Assign the maximum points for each site assessment criterion as shown in §658.5(b) of CFR. In cases of corridor-type projects such as transportation, powerline and flood control, criteria #5 and #6 will not apply and will be weighed zero, however, criterion #8 will be weighed a maximum of 25 points, and criterion #11 a maximum of 25 points.

Individual Federal agencies at the national level, may assign relative weights among the 12 site assessment criteria other than those shown in the FPPA rule. In all cases where other weights are assigned, relative adjustments must be made to maintain the maximum total weight points at 160.

In rating alternative sites, Federal agencies shall consider each of the criteria and assign points within the limits established in the FPPA rule. Sites most suitable for protection under these criteria will receive the highest total scores, and sites least suitable, the lowest scores.

Part VII: In computing the "Total Site Assessment Points", where a State or local site assessment is used and the total maximum number of points is other than 160, adjust the site assessment points to a base of 160. Example: if the Site Assessment maximum is 200 points; and alternative Site "A" is rated 180 points:

$$\frac{\text{Total points assigned Site A}}{\text{Maximum points possible}} = \frac{180}{200} \times 160 = 144 \text{ points for Site "A."}$$

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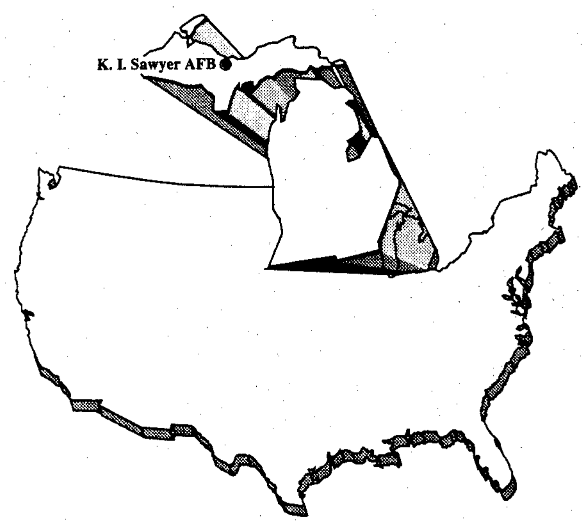

APPENDIX M

APPENDIX M

AGENCY LETTERS AND CERTIFICATIONS

Bureau of Michigan History, State Historic Preservation Office
Michigan Library and Historical Center
717 West Allegan Street
Lansing, Michigan 48918-1800

November 29, 1993

GARY P BAUMGARTEL
LT COL
DEPARTMENT OF THE AIRFORCE
CENTER FOR ENVIRONMENTAL EXCELLENCE
8106 CHENNAULT ROAD
BROOKS AIRFORCE BASE TX 78235-5318

RE: ER-940088 Disposal and reuse of K. I. Sawyer Air Force Base, Marquette County (USAF)

Dear Lt. Col. Baumgartel:

We have received your request for review of the above-cited project. Unfortunately, because we lack sufficient survey data for the project area, we are unable to determine the historic significance of above-ground resources that may be affected by this project. We request that buildings and structures on the base be inventoried by qualified (36 CFR Part 61) professionals. This information will allow us to determine if National Register-eligible properties exist within the project area, and what, if any, effect this project may have on them.

A Bureau of Michigan History inventory card should be prepared for each structure that may be affected by project activities. Each card should contain an original photograph, the street address, and a locational map. Research utilizing such source materials as historic maps, published and unpublished sources, government records, and oral interviews should be performed. A report should then be prepared that sets forth the basic facts in the historical development of the structures in the base. The report should deal with the historical significance of these properties individually, and in the context of the surrounding community as a whole. It should contain recommendations concerning buildings and areas that appear to meet the National Register criteria and a rationale for each determination.

Please note that the Section 106 review process cannot proceed until we are able to consider the information requested above. If you have any questions, please contact the Environmental Review Coordinator at (517) 335-2721.

Sincerely,

Kathryn B. Eckert

Kathryn B. Eckert
State Historic Preservation Officer

KBE:JRH:ROC:em

United States Department of the Interior

BUREAU OF MINES
Intermountain Field Operations Center
P.O. Box 25086
Building 20, Denver Federal Center
Denver, Colorado 80225

December 02, 1993

Lt Co. Gary P. Baumgartel
AFCEE/ESE, 8106 Chennault Road
Brooks AFB TX 78235-5318

Dear Lt Co. Baumgartel:

Subject: Notice of Intent to Prepare an Environmental Impact Statement for Disposal and Reuse of Seven Air Force Bases (ER 93/903)

Personnel of the Bureau of Mines, reviewed the Notice of Intent (NOI) for possible conflict with mineral resources and mineral-producing facilities, as requested by the Director, Office of Environmental Affairs, Department of the Interior. In some instances various mineral resources are situated on or near the Air Force base being considered for disposal.

Preliminary review of available data suggests that the mineral resources included below should be considered during preparation of the various environmental documents.

<u>Gentile AFB Station</u> - Dayton, Montgomery County, Ohio:
Nine sand and gravel pits and four limestone quarries are active in the county. According to state records, about 2.5 million tons of construction aggregates were produced in the county in 1992. Base closure is not expected to significantly affect area mineral resources.

<u>Griffiss AFB</u> - Rome, Oneida County, New York:
At least 12 companies are currently producing construction sand and gravel from 16 pits in Oneida County. At least three of these operations are near the town of Rome. Beazer USA/Hanson is mining crushed limestone southeast of Griffiss in the vicinity of the town of Oriskany. Industrial sand is produced 15 miles west of Rome near the town of McConnellsville. Area mineral resources are not expected to be significantly affected by base closure.

March AFB - Riverside, Riverside County, California:
The area is underlain by sand and gravel. USGS topographic maps of the area show at least five gravel pits and one quarry near the western side of the base. Two pipelines on the north side of the base also are shown on area USGS topographic maps. Area mineral resources and pipeline operations probably would not be significantly impacted by base closure.

Newark AFB - Newark, Licking County, Ohio:
Four sand & gravel pits, one salt brine operation, and one clay operation are active in the county. One sand and gravel pit and the salt operation are near Newark. No significant impact to mineral resources is expected with base closure.

K. I. Sawyer AFB - Marquette, Marquette County, Michigan:
The area of the base is covered by glacially derived material. Four sand and gravel pits, near the western side of the base, are shown on USGS topographic maps of the area. Sand and gravel, mined in the vicinity of the base, probably was used as fill material for base construction. Significant impacts to mineral resources in the area are not expected with base closure.

O'Hare International Airport AF Reserve Station - Chicago, Illinois:
Deposits of clay, limestone/dolomite, and sand and gravel have been mined in the Chicago area. USGS topographic maps of the area show at least one clay pit on the eastern side of the O'Hare International Airport complex, a quarry is shown four miles to the south in the community of Elmhurst, and a large pit area (possible quarry) is about four miles to the north in the Northfield area. Again, no impact is expected to mineral resources with base closure.

Plattsburg AFB - Plattsburg, Clinton County, New York:
Construction sand and gravel is mined by four companies operating six pits in Clinton County. At least four of the operations are in the vicinity of the town of Plattsburg. Plattsburg Quarries Inc. currently mines crushed limestone near Plattsburg. Most of the crushed stone is used for concrete and bituminous aggregate and roadbase. Base closure is not expected to significantly affect mineral resources in the area.

A discussion should be included in the planned Environmental Impact Statement stating whether these or any other mineral resources are present on the affected bases and how they would be affected by disposal and reuse. If no adverse impacts to mineral resources are identified, a statement to that effect should be included.

We appreciate this opportunity to provide comments on the proposed project. Our comments are drawn from available information, are provided on a technical assistance basis only, and may not reflect the position of the Department of the Interior.

If you have questions regarding this review, please contact Robert Wood at (303) 236-0451.

Mark H. Hibpshman
Supervisory Physical Scientist

ESE ___
ESE-D ___
received
21 DEC 199

TAKE PRIDE IN AMERICA

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Bishop Henry Whipple Federal Building
1 Federal Drive
Fort Snelling, MN 55111-4056

IN REPLY REFER TO:

DEC 16 1993

FWS/AES-DHC

Lt. Colonel Gary P. Baumgartel
Chief, Environmental Planning Division
HQ AFCEE/ESE
8106 Chennault Road
Brooks Air Force Base, Texas 78235-5318

Dear Colonel Baumgartel:

Appropriate field offices within Region 3 of the U.S. Fish and Wildlife Service (Service) have reviewed the Air Force's Notice of Intent to Prepare Environmental Impact Statements for Disposal and Reuse of Seven Air Force Bases, as announced in the Federal Register of October 28, 1993. The Chicago, Illinois, Field Office, and Reynoldsburg, Ohio, Field Office provided responses of "No Comment" regarding the proposed disposal and reuse of O'Hare International Airport Air Force Reserve Station, Gentile Air Force Station, and Newark Air Force Base. The comments of the East Lansing, Michigan, Field Office are provided below:

K. I. Sawyer Air Force Base

A search of the Service's endangered species database has revealed no known occurrences of Federal listed, proposed or candidate species on K. I. Sawyer Air Force Base. However, the data presently available are not definitive for the absence of listed species, particularly for plants and invertebrates. Therefore, surveys for listed and candidate plants and invertebrates whose ranges include the area of the air base are recommended. Please contact the East Lansing, Michigan, Field Office for a list of such species and for information concerning characteristics of habitats supporting the species. The results of the recommended surveys should be disclosed in the draft statement.

The draft statement should also address potential impacts of proposed base disposal and reuse on the bald eagle (Haliaeetus leucocephalus), eastern timber wolf (Canis lupus), and Kirtland's warbler (Dendroica kirtlandii). The eagle and wolf are wide ranging species found in the vicinity of K. I. Sawyer Air Force Base. Kirtland's warbler should be included due to the presence of jack pine forest habitat on this installation, and the recent occurrence of male Kirtland's warblers nearby in Marquette County.

We also recommend that the following two Michigan Department of Natural Resources representatives be contacted regarding State of Michigan listed threatened and endangered species, sensitive habitats, and more detailed wildlife locale information:

Mr. Tom Weise
Endangered Species Coordinator
Michigan Department of Natural Resources
Steven T. Mason Building
P. O. Box 30028
Lansing, Michigan 48909

Mr. John Hendrickson
Regional Wildlife Supervisor
Michigan Department of Natural Resources
Region 1 Headquarters
1990 US-41 South
Marquette, Michigan 49855

National Wetlands Inventory maps indicate the presence of wetland habitats on K. I. Sawyer Air Force Base, including some drainages associated with the East Branch Escanaba River. Potential wetlands impacts and long-term protection provisions should be addressed in the draft statement, including compliance with Executive Order 11990 (Protection of Wetlands).

Environmental contamination should also be evaluated with respect to base disposal and reuse options. The draft statement should include a comprehensive survey of potential contaminated sites and planned remedial action, if any is warranted.

For further technical assistance, please contact Mr. Charles Wooley, Field Supervisor, Ecological Services Field Office, U. S. Fish and Wildlife Service, 1405 South Harrison Rd. - Room 302, East Lansing, Michigan 48823 -- Telephone: (517) 337-6650.

The opportunity for the Service to provide our fish and wildlife resource protection recommendations is appreciated.

Questions pertaining to these comments can be directed to Mr. Lynwood MacLean of my staff by calling (612) 725-3538.

Sincerely yours,

John A. Blankenship

Assistant Regional Director
Ecological Services

STATE OF MICHIGAN

JOHN ENGLER, Governor

DEPARTMENT OF NATURAL RESOURCES

Stevens T. Mason Building, P.O. Box 30028, Lansing, MI 48909

ROLAND HARMES, Director

December 21, 1993

Mr. Gary P. Baumgartel
Department of the Air Force
HQ AFCEE/ESE
8106 Chennauet Road
Brooks AFB, TX 78235-5318

Dear Mr. Baumgartel:

Your request for information was checked against known localities for special natural features recorded in the Michigan Natural Features Inventory (MNFI) database, which is part of the Natural Heritage Program, Wildlife Division. The MNFI is an ongoing, continuously updated information base, which is the only comprehensive single source of existing data on Michigan's endangered, threatened, or otherwise significant plant and animal species, natural plant communities, and other natural features.

However, this database is not yet complete for all areas of the state, since some areas have not been significantly or thoroughly surveyed for natural features. Further, populations of plants and animals, and natural communities are constantly changing. Therefore, absence of known records in the MNFI database should not be taken as a definitive statement on lack of occurrence of special features at a site. In some cases, the only way to obtain a definitive statement on the status of natural features is to have a competent biologist perform a complete field survey.

The presence of listed species does not necessarily preclude development but may require alterations in the development plan. An endangered species permit will be required from the Department of Natural Resources, Wildlife Division, if any listed species would be taken or harmed.

If the project is located on or adjacent to wetlands, inland lakes, or streams, additional permits may be required. Contact the Michigan Department of Natural Resources, Land and Water Management Division, P.O. Box 30028, Lansing, MI 48909 (517-373-1170).

The following is a list of species that are located within the vicinity of the KI Sawyer Air Force Base:

Common Loon (Gavia immer) SC
Kirtland's warbler (Dendroica kirtlandii) E
narrow-leafed gentian (Gentiana linearis) T

As you have requested, there are two gentleman within the Wildlife Division of the Michigan Department of Natural Resources that are knowledgeable about the biota in the area: John Hendrickson at the Marquette Office and John Stuht in Escanaba.

Thank you for your advance coordination in addressing the protection of Michigan's Natural Resource Heritage. If you have further questions, please call me at 517-373-1263.

Sincerely,

Thomas F. Weise

Thomas F. Weise
Endangered Species Coordinator
Wildlife Division

M-8

TFW:cjm

Received
JAN 1994

U.S. Department
of Transportation
Federal Aviation
Administration

Airports District Office
Willow Run Airport, East
8820 Beck Road
Belleville, MI 48111

January 12, 1994

Mr. Bruce R. Leighton, P.E.
Technical Assistant
Environmental Planning Division
Department of the Air Force
HQ AFCEE/ESE
8106 Chennault Road
Brooks AFB, TX 78235-5318

Dear Mr. Leighton:

K. I. Sawyer AFB, Oscoda, Michigan
Conversion and Reuse of Environmental Impact Statement (EIS)

We are in receipt of your December 9, 1993, letter and agree that the Federal Aviation Administration (FAA) should be a cooperating agency as long as there appears to be a possible aviation related reuse alternative. The FAA will review and comment on the feasibility of the aviation alternatives and their related environmental impact.

If you have any questions, please contact me at 313-487-7280.

Sincerely,

Ernest P Gubry

Ernest P. Gubry
Community Planner

cc:
AGL-611.1

MICHIGAN DEPARTMENT OF STATE

RICHARD H. AUSTIN • SECRETARY OF STATE

LANSING
MICHIGAN 48918

Bureau of Michigan History, State Historic Preservation Office
Michigan Library and Historical Center
717 West Allegan Street
Lansing, Michigan 48918-1800

April 29, 1994

WILLIAM A MYERS AICP
CHIEF CONSERVATION & PLANNING DIVISION
ENVIRONMENTAL CONSERVATION & PLANNING DIRECTORATE
HQ AFCEE/EC
8106 CHENNAULT ROAD
BROOKS AFB TX 78235-5318

RE: ER-940088 Proposed disposal of KI Sawyer Air Force Base, Marquette County (USAF)

Dear Mr. Myers:

We have received your March 3, 1994, letter and archaeological work plan. While the Michigan SHPO did not request an archaeological study of the K.I. Sawyer Base, we encourage the Air Force in its plans to conduct such a study in order to determine the presence or absence of archaeological sites and complete the requirements of the Section 106 process. The Office of the State Archaeologist has reviewed the work plan and it is their opinion that the plan presents a reasonable and adequate strategy for the archaeological survey of the base.

In addition, we are still concerned with the above-ground buildings and structures on the base. We wish to reiterate our request for a survey with recommendations of national register eligibility expressed in our letter of November 29, 1993.

If you have any questions, please contact the Environmental Review Coordinator at (517) 335-2721. Thank you for this opportunity to review and comment.

Sincerely,

Kathryn B. Eckert

Kathryn B. Eckert
State Historic Preservation Officer

KBE:KMW:DLA:kw
cc: The Earth Technology Corporation
M-10

MICHIGAN DEPARTMENT OF STATE

RICHARD H. AUSTIN • SECRETARY OF STATE

LANSING
MICHIGAN 48918

Bureau of Michigan History, State Historic Preservation Office
Michigan Library and Historical Center
717 West Allegan Street
Lansing, Michigan 48918-1800

October 14, 1994

WILLIAM A MYERS, AICP
CHIEF CONSERVATION & PLANNING DIVISION
ENVIRONMENTAL CONSERVATION & PLANNING DIRECTORATE
HQ AFCEE/EC
8106 CHENNAULT ROAD
BROOKS AFB TX 78235-5318

RE: ER-940088 K.I. Sawyer Air Force Base: Phase I archaeological survey report; Phase II archaeological evaluation research design; Marquette County

Dear Mr. Myers:

We have reviewed the two documents produced by Commonwealth Cultural Resources Group (CCRG) entitled "Phase I Archaeological Survey" and "Research Design: Phase II Archaeological Evaluation." We agree that sites 20MQ88 and 20MQ92 are not eligible for listing in the National Register of Historic Places. Further, we also concur with CCRG's recommendation that Phase II investigations be conducted at sites 20MQ89, 20MQ90, 20MQ91, 20MQ93, and 20MQ94.

In general, we are in agreement with the research specifications proposed for the Phase II investigations. We would, however, like to make the following comments. CCRG interprets 20MQ93 as a charcoal kiln complex which includes the remains of one kiln, an area that may have been in preparation for a second kiln, and a storage facility. Forty-eight shovel tests at 20MQ93 produced only 17 artifacts, all bottle glass. The small number of artifacts is not unexpected for a site of this type. We agree with the functional interpretation of the site based on the existing evidence.

CCRG interprets site 20MQ94 as the probable location of a prepared site for a proposed charcoal kiln that was never constructed. We agree that the area defined by the rock facing may indeed be a proposed kiln site. CCRG excavated forty-nine shovel tests at this site. In contrast to the results at 20MQ93, the shovel tests at 20MQ94 produced 355 artifacts. This assemblage is made up of domestic artifacts and structural debris. In particular, there is a strong concentration of positive shovel tests in the clearing on top of the knoll immediately south of the rock facing. In both the Phase I report and in the Phase II research design, 20MQ94 is interpreted as a component of a small industrial complex which is made up of the two sites: 20MQ93 and 94. We do not disagree with this possibility. However, both documents imply that the significance of 20MQ94 is as a

proposed kiln site. We feel that the primary function of the site, and consequently, the primary significance of the site, is an issue that is not yet clear. The size and content of the artifact assemblage from 20MQ94, especially in comparison with that from site 20MQ93, suggests that there may have been a domestic structure on the knoll. It appears to us that there is the potential for 20MQ93 and 20MQ94 to be very different types of sites. This may be an important factor in developing the field testing strategy at the two sites. For example, the prospects for recovering a substantial artifact sample at 20MQ93 appear dim. But, the site has the potential to provide important structural data on the features present, especially the kiln. At 20MQ94, the possibility that there was a structure on the knoll needs to be explored. As part of the testing strategy, this may require trenching designed to locate any structure foundations that may exist.

In addition, we think that observations made in the Phase II research design document on page 2-2 regarding the proximity of the two sites to the Chicago and Northwestern railroad line are important. We would like to see a map illustrating the spatial relationships described in that paragraph included in the report on the Phase II investigations. This map would need to be based in part on the 1939 air photo and should include sites 20MQ93 and 20MQ94, the farm to the north, Sands Station, the railroad tracks, and the two-track road that runs from the sites to Sands Station.

If you have any questions, please contact the Environmental Review Coordinator at (517) 335-2721. Thank you for this opportunity to review and comment.

Sincerely,

Kathryn B. Eckert
State Historic Preservation Officer

KBE:DLA:kmw

received
1 3 SEP 1995

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Green Bay ES Field Office
1015 Challenger Court
Green Bay, Wisconsin 54311-8331

August 17, 1995

Thomas H. Gross, Colonel, U.S.A.F.
Director, Environmental Conservation and Planning
HQ AFCEE/EC
8106 Chennault Road
Brooks AFB, Texas 78235-5318

Re: Disposal and Reuse of K.I. Sawyer
Air Force Base
Sawmill Timber Procurement Area in
Northeast, Wisconsin

Dear Colonel Gross:

The U.S. Fish and Wildlife Service has received your letter dated June 23, 1995, requesting comments on the subject project. Due to staff time constraints and priority work activities, we are able to only review your project for potential impacts to federally-listed threatened and endangered species or those proposed for listing. Be advised that other environmental concerns may be associated with this project such as wetland and stream impacts, erosion control needs, and effects on state-listed threatened or endangered species. State or federal permits may be needed, as well, if stream or wetland impacts will occur. If resource impacts are expected to occur, we recommend that you forward this project to the appropriate Wisconsin Department of Natural Resources office for their review.

Please provide us copies of any future review documents that may be associated with this project or of future projects you may be planning that would require Service review. This will allow us to keep our files current. We will provide comments as time and work priorities allow.

Federally-Listed Threatened and Endangered Species

A review of information in our files indicates that the following federally-listed threatened or endangered species occur in Marinette, Florence, Forest, Oconto, Shawano, Menominee, Langlade, Lincoln, Oneida, Vilas, Iron, Price and Taylor Counties:

Classification	Common Name	Scientific Name	Habitat
threatened	bald eagle	Haliaeetus leucocephalus	breeding and wintering
endangered	gray wolf	Canis lupus	northern forested areas
endangered	Karner blue butterfly	Lycaeides melissa samuelis	prairie, oak savanna, and jack pine areas w/wild lupine

There are numerous bald eagle nests and wintering sites, and gray wolves are present in the counties in Wisconsin proposed to procure timber for the alternatives to reuse and develop a sawmill on K.I. Sawyer Air Force Base. Further, there are a few sites in Oconto, Shawano, and Menominee counties in Wisconsin where Karner blue butterflies are present. All three of these species may be impacted by timber harvesting in Wisconsin. The information

you provided in your June 23, 1995 letter is not site-specific enough for us to determine potential impacts to these federally-listed endangered and threatened species. When you develop more site-specific information, please reinitiate consultation with our office so that we may evaluate proposed project impacts on these species in accordance with the Endangered Species Act of 1973, as amended. Further, the U.S. Air Force should make a determination as to whether the proposed project may affect federal endangered and threatened species and advise this office. If it is determined that the project may adversely affect listed species, initiation of the formal consultation process should be requested.

If we can be of further assistance, please contact Mr. Ronald Spry of my staff at 414-433-3803.

Sincerely,

Janet M. Smith

Janet M. Smith
Field Supervisor

cc: FWS, ELFO, East Lansing, Michigan

MICHIGAN DEPARTMENT OF STATE
Candice S. Miller, Secretary of State

Lansing, Michigan 48918-0001

received
13 SEP 1995
AWS

STATE HISTORIC PRESERVATION OFFICE
Michigan Historical Center
717 West Allegan Street
Lansing, Michigan 48918-1800

August 24, 1995

MR BRUCE R LEIGHTON PE
TECHNICAL ASSISTANT
ENVIRONMENTAL CONSERVATION & PLANNING DIRECTORATE
DEPT OF THE AIR FORCE
HQ AFCEE/EC
8106 CHENNUALT ROAD
BROOKS AFB TX 78235-5318

RE: ER-940088 Disposal and reuse, K.I. Sawyer Air Force Base (USAF)

Dear Mr. Leighton:

We have reviewed the report prepared by Commonwealth Cultural Resources Group (CCRG) and Earth Tech entitled "Final Phase II Archaeological Investigation, April 1995: K.I. Sawyer Air Force Base, Marquette County, Michigan."

CCRG performed Phase II evaluation of three precontact Native American sites (20MQ89, 20MQ90 and 20MQ91) and two late nineteenth-early twentieth century Euroamerican sites (20MQ93 and 20MQ94). CCRG recommends that two of the precontact sites, 20MQ90 and 20MQ91, appear to be eligible for listing in the National Register of Historic Places. They recommend that the other three sites do not appear to be eligible.

We agree that sites 20MQ90 and 20MQ91 appear to be eligible for listing in the national register. Both sites produced intact, subsurface features containing organic material which allowed radiocarbon dates to be obtained. These sites hold the potential to provide information, including subsistence data, about small, seasonally occupied interior campsites. In addition, it is our opinion that the other sites (20MQ89, 20MQ93 and 20MQ94) do not appear to be eligible for listing in the national register.

The rules and regulations for implementing the provisions of section 106 of the National Historic Preservation Act state that transfer, sale, or lease of an historic property constitutes an adverse effect on the property (36 CFR 800.9[b]). However, transfer, sale or lease of an historic property may be considered to have no adverse effect if "adequate restrictions or conditions are included to ensure preservation of the property's significant historic features" (36 CFR 800.9[c]). Consequently, disposal of K.I. Sawyer Air Force Base would have no adverse effect upon sites 20MQ90 and 20MQ91 as long as provisions for their protection were included in the transfer documents. Such provisions could be deed restrictions which provide for the preservation of the sites in place. It may also be stipulated, however, that if preservation in place became unfeasible, adequate and appropriate mitigation measures would be implemented

to recover and preserve the data present at the sites. These contingencies would be spelled out in the covenant.

We will continue to work with the Air Force in developing necessary provisions for protection of the sites to be included in the transfer documents. If you have any questions, please contact Kristine Wilson, Environmental Review Coordinator, at (517) 335-2721. Thank you for this opportunity to review and comment.

Sincerely,

Kathryn B. Eckert

Kathryn B. Eckert
State Historic Preservation Officer

KBE:DLA:kmw

MICHIGAN DEPARTMENT OF STATE
Candice S. Miller, Secretary of State

Lansing, Michigan 48918-0001

STATE HISTORIC PRESERVATION OFFICE
Michigan Historical Center
717 West Allegan Street
Lansing, Michigan 48918-1800

September 1, 1995

MR BRUCE R LEIGHTON PE
DEPARTMENT OF AIR FORCE
HQ AFCEE EC
8106 CHENNAULT ROAD
BROOKS AFB TX 78235-5318

RE: ER-940088 Historic Building Inventory evaluation, K.I. Sawyer AFB, Marquette County (USAF)

Dear Mr. Leighton:

Under the authority of the National Historic Preservation Act of 1966, as amended, we have reviewed the above-cited project at the location noted above. It is the opinion of the State Historic Preservation Officer (SHPO) that the project will affect no historic properties (no known sites eligible for listing in the National Register of Historic Places) and that the project is cleared under federal regulation 36 CFR 800 for the "Protection of Historic Properties."

Please maintain a copy of this letter with your environmental review record for this project. If the scope of work changes in any way, or if artifacts or bones are discovered, please contact this office immediately. This letter evidences your compliance with 36 CFR 800.4, "Identifying Historic Properties," and the fulfillment of your responsibility to notify this office under 36 CFR 800.4(d), "When no historic properties found."

If you have any questions, please contact Kristine Wilson, Environmental Review Coordinator, at (517) 335-2721. Thank you for this opportunity to review and comment.

Sincerely,

John R. Halsey for

Kathryn B. Eckert
State Historic Preservation Officer

KBE:BDC:cm

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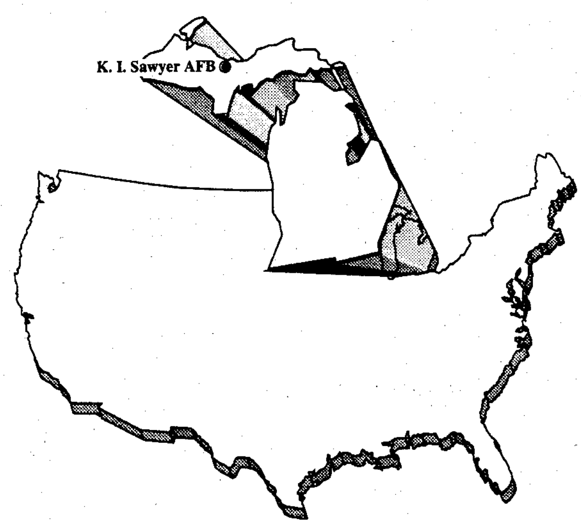


APPENDIX N

APPENDIX N

INFLUENCING FACTORS AND ENVIRONMENTAL IMPACTS BY LAND USE CATEGORY

APPENDIX N

INFLUENCING FACTORS AND ENVIRONMENTAL IMPACTS BY LAND USE CATEGORY

INTRODUCTION

The purpose of this appendix is to quantify the environmental impacts of each land use category identified for the four alternatives, including the Proposed Action, evaluated in this Environmental Impact Statement (EIS). The data in Tables N-1 through N-16 present the impacts of individual land use activities, such as industrial, commercial, or institutional, on their respective Regions of Influence and allow comparison of the impacts of the Proposed Action and alternatives for three benchmark years, 2000, 2005, and 2015, where applicable. Figures N-1 through N-4 display the parcels in the various land use categories for the Proposed Action and alternatives.

Tables N-1 through N-4 present data on the influencing factors (factors that drive environmental impacts); Tables N-5 through N-16 list the impacts on individual environmental resources evaluated in the EIS. These resources include transportation, utilities, hazardous materials and hazardous waste management, geology and soils, water resources, air quality, noise, biological resources, and cultural resources. This appendix includes at least one table for each resource area, except water resources and air quality. Data on water demand are presented as part of the utilities analysis; the effects on surface and groundwater resources in and around the base have not been quantified in the EIS and have not been disaggregated in this appendix. The air emissions associated with each alternative for each benchmark year are described in detail in Appendix I and have not been included in this appendix.

No quantification is provided in Table N-11 because the quantities of hazardous materials used and hazardous wastes generated will depend on the type and intensity of industrial and commercial activities developed on the site. Table N-11 presents a generalized description of the hazardous materials used under individual land use categories. Table N-12 summarizes the number of Installation Restoration Program (IRP) sites identified on the base as of 1994, but does not give the likely status of these sites in 2000, 2005, and 2015.

Factors and assumptions used in disaggregating the total impacts of an alternative into individual land use categories are presented as footnotes on the relevant tables.

Table N-1. Direct Employment by Land Use Category, K. I. Sawyer AFB Reuse

	2000				2005				2015			
Land Use Category	P.A.	Alt. 1	Alt. 2	Alt. 3	P.A.	Alt. 1	Alt. 2	Alt. 3	P.A.	Alt. 1	Alt. 2	Alt. 3
Airfield	0	0	0	NA	0	0	0	NA	0	0	0	NA
Aviation support	245	527	391	NA	476	759	748	NA	951	1,030	779	NA
Industrial	2,090	463	347	174	3,963	839	408	215	7,705	1,586	602	291
Institutional (medical/educational)	13	249	238	28	31	236	391	50	59	234	623	103
Commercial	266	263	76	57	527	509	119	107	1,040	1,000	200	214
Residential	0	6	0	4	0	10	0	6	0	11	0	9
Public facilities/recreation	41	31	33	142	56	33	34	253	89	33	22	239
Agriculture	0	0	0	NA	0	0	0	NA	0	0	0	NA
Military	63	NA	NA	NA	61	NA	NA	NA	59	NA	NA	NA
Total	2,718	1,539	1,085	405	5,114	2,386	1,700	631	9,903	3,894	2,226	856

Table N-2. Total Employment by Land Use Category, K. I. Sawyer AFB Reuse

	2000				2005				2015			
Use Category	P.A.	Alt. 1	Alt. 2	Alt. 3	P.A.	Alt. 1	Alt. 2	Alt. 3	P.A.	Alt. 1	Alt. 2	Alt. 3
Airfield	0	0	0	NA	0	0	0	NA	0	0	0	NA
Aviation support	425	854	648	NA	831	1,258	1,235	NA	1,667	1,674	1,262	NA
Industrial	3,627	753	576	246	6,924	1,376	673	303	13,511	2,574	973	421
Institutional (medical/educational)	24	402	396	40	54	393	646	71	104	386	1,009	149
Commercial	462	427	126	80	920	825	196	152	1,824	1,673	325	310
Residential	0	25	0	6	0	39	0	9	0	64	0	12
Public facilities/recreation	71	50	55	200	98	39	56	357	156	64	36	347
Agriculture	0	0	0	NA	0	0	0	NA	0	0	0	NA
Military	108	NA	NA	NA	107	NA	NA	NA	104	NA	NA	NA
Total	4,717	2,511	1,801	572	8,934	3,930	2,806	892	17,366	6,435	3,605	1,239

Note: Total employment includes direct and secondary employment.
Alt. 1 = International Wayport Alternative
Alt. 2 = Commercial Aviation Alternative
Alt. 3 = Recreation Alternative
NA = not applicable
P.A. = Proposed Action

Table N-3. Population In-Migration by Land Use Category, K. I. Sawyer AFB Reuse

Land Use Category	2000 P.A.	2000 Alt. 1	2000 Alt. 2	2000 Alt. 3	2005 P.A.	2005 Alt. 1	2005 Alt. 2	2005 Alt. 3	2015 P.A.	2015 Alt. 1	2015 Alt. 2	2015 Alt. 3
Airfield	0	0	0	NA	0	0	0	NA	0	0	0	NA
Aviation support	227	480	358	NA	466	739	724	NA	1,006	1,055	805	NA
Industrial	1,944	423	318	151	3,886	808	395	201	8,156	1,621	621	293
Institutional (medical/educational)	13	226	219	25	30	231	378	47	63	243	644	104
Commercial	248	240	70	48	517	485	115	101	1,101	1,055	207	215
Residential	0	14	0	4	0	23	0	6	0	41	0	9
Public facilities/recreation	38	28	30	123	55	23	33	237	94	41	24	242
Agriculture	NA	0	0	NA	NA	0	0	NA	NA	0	0	NA
Military	58	NA	NA	NA	60	NA	NA	NA	63	NA	NA	NA
Total	2,528	1,411	995	351	5,014	2,309	1,645	592	10,483	4,056	2,301	863

Note: Population in-migration is based on projected total employment for each land use category.

Table N-4. Land Use Impacts by Land Use Category, K. I. Sawyer AFB Reuse (acres of absorption)

Land Use Category	2000 P.A.	2000 Alt. 1	2000 Alt. 2	2000 Alt. 3	2005 P.A.	2005 Alt. 1	2005 Alt. 2	2005 Alt. 3	2015 P.A.	2015 Alt. 1	2015 Alt. 2	2015 Alt. 3
Airfield	1,156	814	510	NA	1,156	814	510	NA	1,156	1,055	510	NA
Aviation support	80	128	158	NA	159	189	316	NA	319	260	325	NA
Industrial	295	181	105	59	545	234	159	71	1,047	340	272	89
Institutional (medical/educational)	4	162	167	13	9	162	303	27	17	161	546	56
Commercial	11	17	5	2	22	32	7	5	43	63	10	10
Residential	38	269	37	15	76	377	74	30	152	538	147	60
Public facilities/recreation	393	1,118	1,387	2,078	560	1,118	1,387	3,986	896	1,118	1,387	3,986
Agriculture	NA	874	1,489	NA	NA	874	1,489	NA	NA	874	1,489	NA
Military	193	NA	NA	NA	193	NA	NA	NA	193	NA	NA	NA
Total	2,170	3,563	3,858	2,167	2,720	3,800	4,245	4,119	3,822	4,409	4,686	4,201

Alt. 1 = International Wayport Alternative
Alt. 2 = Commercial Aviation Alternative
Alt. 3 = Recreation Alternative
NA = not applicable
P.A. = Proposed Action

Table N-5. Transportation Impacts by Land Use Category, K. I. Sawyer AFB Reuse (average daily trips)

	2000				2005				2015			
Land Use Category	P.A.	Alt. 1	Alt. 2	Alt. 3	P.A.	Alt. 1	Alt. 2	Alt. 3	P.A.	Alt. 1	Alt. 2	Alt. 3
Airfield	0	0	0	NA	0	0	0	NA	0	0	0	NA
Aviation support	796	1,654	1,440	NA	1,590	2,488	2,892	NA	3,156	3,450	3,045	NA
Industrial	6,073	1,435	753	234	11,951	2,657	913	356	23,728	5,110	1,345	558
Institutional (medical/educational)	23	3,885	3,369	234	45	3,872	6,042	489	90	3,872	10,760	992
Commercial	827	1,896	781	130	1,653	3,705	1,465	267	3,307	7,336	2,701	496
Residential	683	5,191	631	390	1,365	7,242	1,262	757	2,730	10,345	2,523	1,550
Public facilities/recreational	315	289	326	1,612	463	286	326	2,581	756	287	326	2,604
Agriculture	NA	0	0	NA	NA	0	0	NA	NA	0	0	NA
Military	183	NA	NA	NA	183	NA	NA	NA	183	NA	NA	NA
Total	8,900	14,350	7,300	2,600	17,250	20,250	12,900	4,450	33,950	30,400	20,700	6,200

Note: The number of vehicle trips expected as a result of specific land uses was estimated on the basis of direct on-site jobs and other attributes of on-site land uses (such as the number of dwelling units, commercial and industrial development, and other factors).

Table N-6. Water Consumption by Land Use Category, K. I. Sawyer AFB Reuse (gallons per day)

	2000				2005				2015			
Land Use Category	P.A.	Alt. 1	Alt. 2	Alt. 3	P.A.	Alt. 1	Alt. 2	Alt. 3	P.A.	Alt. 1	Alt. 2	Alt. 3
Airfield	0	0	0	NA	0	0	0	NA	0	0	0	NA
Aviation support	31,500	28,800	84,000	NA	63,400	50,000	160,000	NA	130,000	74,000	197,600	NA
Industrial	803,100	21,600	17,500	2,000	1,611,700	40,000	25,600	3,400	3,290,300	88,800	41,600	5,400
Institutional (medical/educational)	1,100	194,400	150,500	16,000	2,300	210,000	294,400	32,300	4,500	236,800	540,800	62,100
Commercial	7,900	7,200	3,500	2,000	15,900	10,000	6,400	3,400	32,600	29,600	5,200	8,100
Residential	67,700	446,400	63,000	40,000	136,300	670,000	121,600	83,300	278,100	1,021,200	228,800	151,200
Public facilities/recreation	32,900	21,600	31,500	40,000	34,500	20,000	32,000	47,600	38,200	29,600	26,000	43,200
Agriculture	NA	0	0	NA	NA	0	0	NA	NA	0	0	NA
Military	15,800	NA	NA	NA	15,900	NA	NA	NA	16,300	NA	NA	NA
Total	960,000	720,000	350,000	100,000	1,880,000	1,000,000	640,000	170,000	3,790,000	1,480,000	1,040,000	270,000

Alt. 1 = International Wayport Alternative
Alt. 2 = Commercial Aviation Alternative
Alt. 3 = Recreation Alternative
NA = not applicable
P.A. = Proposed Action

Table N-7. Wastewater Generation by Land Use Category, K. I. Sawyer AFB Reuse (gallons per day)

	2000				2005				2015			
Land Use Category	P.A.	Alt. 1	Alt. 2	Alt. 3	P.A.	Alt. 1	Alt. 2	Alt. 3	P.A.	Alt. 1	Alt. 2	Alt. 3
Airfield	0	0	0	NA	0	0	0	NA	0	0	0	NA
Aviation support	42,700	24,000	70,000	NA	85,900	42,000	132,600	NA	177,900	62,000	154,800	NA
Industrial	302,400	18,000	16,800	1,400	601,900	33,600	20,400	2,600	1,240,700	74,400	34,400	4,200
Institutional (medical/educational)	1,600	162,000	134,400	17,500	3,300	176,400	244,800	32,500	6,600	198,400	464,400	56,700
Commercial	10,700	6,000	1,400	2,100	21,500	8,400	2,550	3,900	44,600	24,800	4,300	6,300
Residential	91,900	384,000	56,000	44,800	184,700	579,600	107,100	83,200	382,700	880,400	197,800	136,500
Public facilities/ recreation	1,900	6,000	1,400	4,200	3,800	0	2,550	7,800	7,900	0	4,300	6,300
Agriculture	NA	0	0	NA	NA	0	0	NA	NA	0	0	NA
Military	18,800	NA	NA	NA	18,900	NA	NA	NA	19,600	NA	NA	NA
Total	470,000	600,000	280,000	70,000	920,000	840,000	510,000	130,000	1,880,000	1,240,000	860,000	210,000

Table N-8. Solid Waste Generation by Land Use Category, K. I. Sawyer AFB Reuse (tons per day)

	2000				2005				2015			
Land Use Category	P.A.	Alt. 1	Alt. 2	Alt. 3	P.A.	Alt. 1	Alt. 2	Alt. 3	P.A.	Alt. 1	Alt. 2	Alt. 3
Airfield	0	0	0	NA	0	0	0	NA	0	0	0	NA
Aviation support	0.87	1.27	1.14	NA	1.75	1.79	2.25	NA	3.61	2.70	2.52	NA
Industrial	7.21	1.41	1.14	0.07	14.08	2.39	1.54	0.17	28.53	4.20	2.33	0.34
Institutional (medical/educational)	0.05	3.67	3.01	0.35	0.10	3.79	5.68	0.66	0.21	4.20	10.27	1.43
Commercial	1.04	0.56	0.20	0.19	2.10	1.40	0.24	0.35	4.32	2.70	0.48	0.17
Residential	1.48	7.19	1.00	0.76	3.00	10.57	2.01	1.38	6.18	16.17	3.69	1.83
Public facilities/recreation	0.09	0	0.20	0.48	0.18	0	0.11	0.90	0.37	0	0.09	1.94
Agriculture	NA	0	0	NA	NA	0	0	NA	NA	0	0	NA
Military	0.82	NA	NA	NA	0.83	NA	NA	NA	0.86	NA	NA	NA
Total	11.56	14.10	6.69	1.85	22.04	19.94	11.83	3.46	44.08	29.97	19.38	5.71

Alt. 1 = International Wayport Alternative
Alt. 2 = Commercial Aviation Alternative
Alt. 3 = Recreation Alternative
NA = not applicable
P.A. = Proposed Action

Table N-9. Electricity Demand by Land Use Category, K. I. Sawyer AFB Reuse (megawatt-hours per day)

	2000				2005				2015			
Land Use Category	P.A.	Alt. 1	Alt. 2	Alt. 3	P.A.	Alt. 1	Alt. 2	Alt. 3	P.A.	Alt. 1	Alt. 2	Alt. 3
Airfield	0	0	0	NA	0	0	0	NA	0	0	0	NA
Aviation support	4.68	7.94	7.20	NA	9.40	11.85	14.19	NA	19.18	16.92	15.84	NA
Industrial	37.01	11.12	6.13	0.48	69.21	16.16	8.39	1.25	135.98	26.15	12.67	2.30
Institutional (medical/educational)	0.75	19.06	17.30	1.99	1.47	19.39	31.61	3.91	2.98	21.54	58.09	7.68
Commercial	1.97	1.59	0.36	0.24	3.96	3.23	0.64	0.47	8.08	6.15	1.06	1.02
Residential	6.72	38.91	5.05	2.56	13.51	56.01	9.68	4.84	27.56	81.54	17.95	9.47
Public facilities/recreation	2.39	0.79	0	2.72	4.80	1.08	0	5.15	9.80	1.54	0	5.12
Agriculture	NA	0	0	NA	NA	0	0	NA	NA	0	0	NA
Military	1.54	NA	NA	NA	1.55	NA	NA	NA	1.58	NA	NA	NA
Total	55.06	79.41	36.04	7.99	103.90	107.72	64.51	15.62	205.16	153.84	105.61	25.59

Table N-10. Natural Gas Demand by Land Use Category, K. I. Sawyer AFB Reuse (therms per day)

	2000				2005				2015			
Land Use Category	P.A.	Alt. 1	Alt. 2	Alt. 3	P.A.	Alt. 1	Alt. 2	Alt. 3	P.A.	Alt. 1	Alt. 2	Alt. 3
Airfield	0	0	0	NA	0	0	0	NA	0	0	0	NA
Aviation support	47,500	79,200	58,500	NA	97,400	118,800	122,400	NA	203,800	175,200	118,800	NA
Industrial	401,700	108,000	89,700	809,600	763,500	168,300	122,400	833,000	1,522,000	292,000	205,200	872,000
Institutional (medical/ educational)	15,200	208,800	198,900	17,600	29,600	227,700	353,600	49,000	59,600	233,600	604,800	87,200
Commercial	39,000	28,800	7,800	8,800	81,700	59,400	13,600	9,800	167,700	116,800	21,600	10,900
Residential	54,200	280,800	35,100	8,800	111,300	396,000	68,000	29,400	230,800	627,800	129,600	54,500
Public facilities/recreation	30,500	14,400	0	35,200	64,300	19,800	0	58,800	133,500	14,600	0	65,400
Agriculture	NA	0	0	NA	NA	0	0	NA	NA	0	0	NA
Military	11,900	NA	NA	NA	12,200	NA	NA	NA	12,600	NA	NA	NA
Total	600,000	720,000	390,000	880,000	1,160,000	990,000	680,000	980,000	2,330,000	1,460,000	1,080,000	1,090,000

Alt. 1 = International Wayport Alternative
Alt. 2 = Commercial Aviation Alternative
Alt. 3 = Recreation Alternative
NA = not applicable
P.A. = Proposed Action

Table N-11. Hazardous Materials Usage by Land Use Category, K. I. Sawyer AFB Reuse, 2000-2015

Land Use Category	Proposed Action	International Wayport Alternative	Commercial Aviation Alternative	Recreation Alternative
Airfield	Aviation fuels, glycols, hydraulic fluids, POL	Aviation fuels, glycols, hydraulic fluids, POL	Aviation fuels, glycols, hydraulic fluids, POL	NA
Aviation support	Aerosols, aviation fuels, batteries, corrosives, degreasers, glycols, heating oils, hydraulic fluids, ignitables, motor fuels, paints, pesticides, plating chemicals, POL, reactives, solvents, thinners	Aerosols, aviation fuels, batteries, corrosives, degreasers, glycols, heating oils, hydraulic fluids, ignitables, motor fuels, paints, pesticides, plating chemicals, POL, reactives, solvents, thinners	Aerosols, aviation fuels, batteries, corrosives, degreasers, glycols, heating oils, hydraulic fluids, ignitables, motor fuels, paints, pesticides, plating chemicals, POL, reactives, solvents, thinners	NA
Industrial	Aerosols, cleaners, corrosives, degreasers, heating oil, hydraulic fluids, ignitables, motor fuels, paints, pesticides, plating chemicals, POL, solvents, thinners	Aerosols, cleaners, corrosives, degreasers, heating oil, hydraulic fluids, ignitables, motor fuels, paints, pesticides, plating chemicals, POL, solvents, thinners	Aerosols, cleaners, corrosives, degreasers, heating oils, hydraulic fluids, ignitables, motor fuels, paints, pesticides, plating chemicals, POL, solvents, thinners	Aerosols, cleaners, corrosives, degreasers, heating oils, hydraulic fluids, ignitables, motor fuels, paints, pesticides, plating chemicals, POL, reactives, solvents, thinners
Institutional (medical/educational)	Heating oils, household products, paints, pesticides, pharmaceuticals, POL, radiological sources, thinners	Cleaners, corrosives, fertilizers, heating oils, household products, ignitables, motor fuels, paints, pesticides, pharmaceuticals, POL, radiological sources, small arms ammunition, solvents, thinners	Batteries, cleaners, corrosives, fertilizers, heating oils, household products, motor fuels, paints, pesticides, pharmaceuticals, POL, radiological sources, small arms ammunition, thinners, water softening chemicals	Aerosols, cleaners, corrosives, heating oils, household products, ignitables, motor fuels, paints, pesticides, POL, solvents, thinners
Commercial	Heating oils, household products, paints, pesticides, thinners	Aerosols, batteries, cleaners, corrosives, heating oils, household products, ignitables, motor fuels, paints, pesticides, POL, solvents, thinners	Aerosols, corrosives, heating oils, household products, paints, pesticides, POL, thinners	Heating oils, household products, paints, pesticides, thinners
Residential	Cleaners, fertilizers, household products, motor fuels, oils, pesticides	Cleaners, fertilizers, household products, motor fuels, oils, pesticides	Cleaners, fertilizers, household products, motor fuels, paints, pesticides, POL, thinners	Cleaners, fertilizers, household products, motor fuels, paints, pesticides, POL, thinners
Public facilities/recreation	Aerosols, chlorine, cleaners, fertilizers, heating oils, motor fuels, paints, pesticides, POL, small arms ammunition, solvents, thinners	Aerosols, chlorine, cleaners, fertilizers, heating oils, household products, motor fuels, paints, pesticides, POL, solvents, thinners	Aerosols, chlorine, cleaners, fertilizers, heating oils, household products, motor fuels, paints, pesticides, POL, thinners	Aerosols, chlorine, cleaners, fertilizers, heating oils, household products, motor fuels, paints, pesticides, POL, thinners
Agriculture	NA	Motor fuels, pesticides, POL	Motor fuels, pesticides, POL	NA
Military	Batteries, cleaners, corrosives, glycols, household products, ignitables, motor fuels, paint, POL, small arms ammunition, solvents, thinners	NA	NA	NA

Note: Quantities of hazardous materials used will depend on the specific industrial development and are not reported here.
NA = not applicable
POL = petroleum, oil, and lubricants

Table N-12. Number of Installation Restoration Program Sites by Land Use Category, K. I. Sawyer AFB Reuse

Land Use Category	1994			
	P.A.	Alt. 1	Alt. 2	Alt. 3
Airfield	6	4	0	NA
Aviation support	6	8	7	NA
Industrial	7	5	2	9
Institutional (medical/educational)	0	2	7	3
Commercial	2	3	0	0
Residential	0	0	0	0
Public facilities/recreation	7	4	4	13
Agriculture	NA	3	5	NA
Military	0	NA	NA	NA

Note: Table shows Installation Restoration Program sites as of 1994. The number of sites over the 1994-2015 period would change as remediation measures are implemented for individual sites.

Table N-13. Geology and Soils Impacts by Land Use Category, K. I. Sawyer AFB Reuse, 2000-2015 (acres of ground disturbance)

Land Use Category	P.A.	Alt. 1	Alt. 2	Alt. 3
Airfield	0	94	0	NA
Aviation support	56	74	9	NA
Industrial	620	121	29	7
Institutional (medical/educational)	1	0	11	3
Commercial	0	3	1	1
Residential	4	0	0	0
Public facilities/recreation	0	0	61	190
Agriculture	NA	88	148	NA
Military	0	NA	NA	NA
Total	681	380	259	201

Note: Disturbance of soils would depend upon the construction schedules of various facilities on base. Therefore, no breakdown is provided for the benchmark years 2000, 2005, and 2015.
Alt. 1 = International Wayport Alternative
Alt. 2 = Commercial Aviation Alternative
Alt. 3 = Recreation Alternative
NA = not applicable
P.A. = Proposed Action

Table N-14. Expected Noise Levels by Land Use Category, K. I. Sawyer AFB Reuse, 2000-2015 (typical day-night average sound level in decibels)

Land Use Category	P.A.	Alt. 1	Alt. 2	Alt. 3
Airfield	65-75	65-75	65-75	NA
Aviation support	<65	65-75	<65	NA
Industrial	<65	65-75	<65	< 65
Institutional (medical/educational)	<65	< 65	<65	< 65
Commercial	<65	< 65	<65	< 65
Residential	<65	< 65	<65	< 65
Public facilities/recreation	<65	65-70	<65	< 65
Agriculture	NA	65-70	65-75	NA
Military	<65	NA	NA	NA

< = less than

Table N-15. Biological Resource Impacts by Land Use Category, K. I. Sawyer AFB Reuse (acres of wetland habitat disturbed)

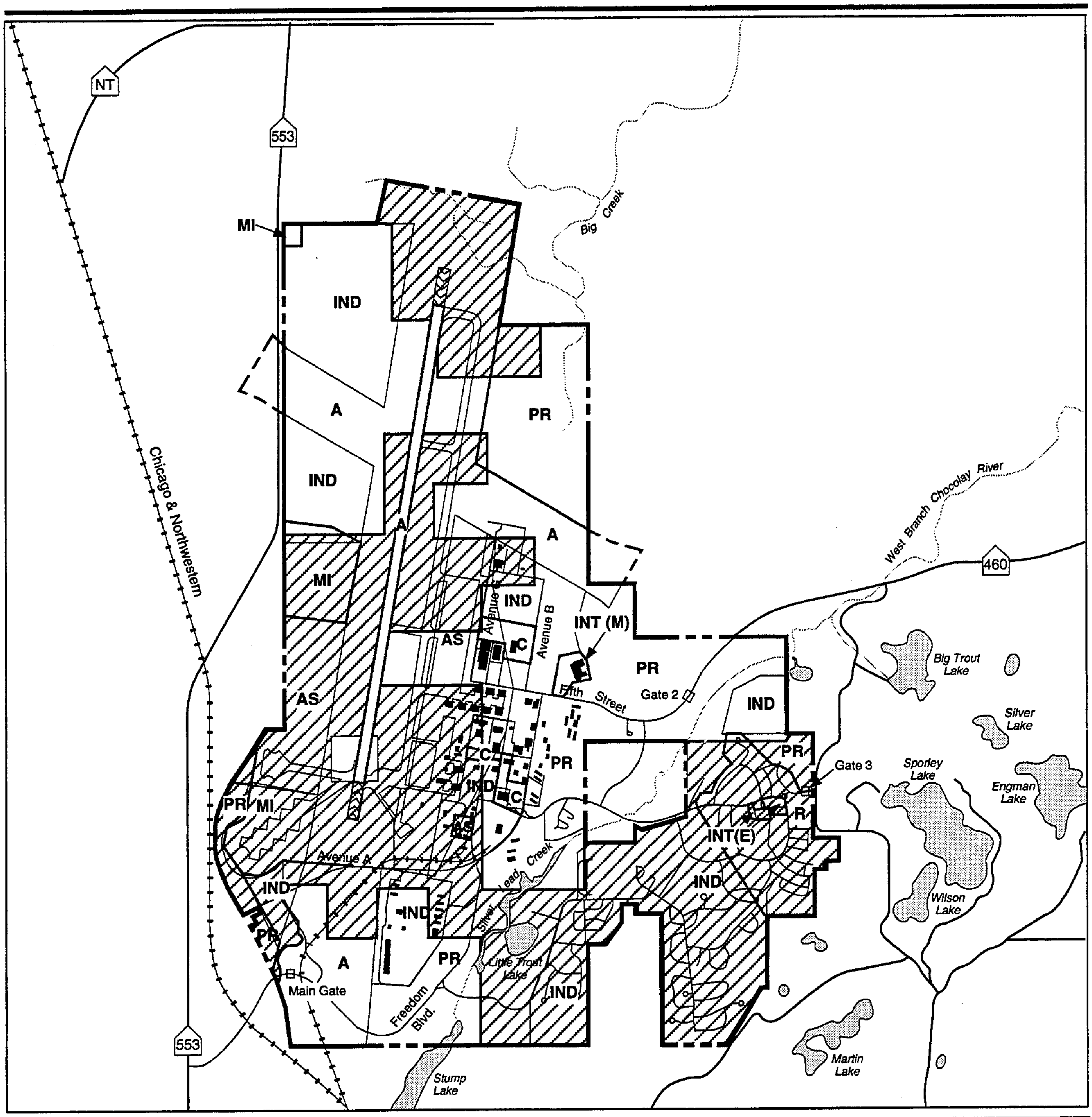
Land Use Category	P.A.	Alt. 1	Alt. 2	Alt. 3
Airfield	0.0	2	0.0	NA
Aviation support	0.5	0.5	0.5	NA
Industrial	2	0.5	1	2
Institutional (medical)	0.0	0.0	NA	NA
Institutional (educational)	0.0	0.0	2.5	0.0
Commercial	0.0	0.0	0.0	0.0
Residential	0.0	0.0	0.0	0.0
Public facilities/recreation	0.0	0.0	0.0	0.5
Agriculture	NA	5.5	5.5	NA
Military	0.0	NA	NA	NA
Total	2.5	8.5	9.5	2.5

Note: Disturbance over the 2000-2015 period.
Alt. 1 = International Wayport Alternative
Alt. 2 = Commercial Aviation Alternative
Alt. 3 = Recreation Alternative
NA = not applicable
P.A. = Proposed Action

Table N-16. Cultural Resource by Land Use Category, K. I. Sawyer AFB Reuse (number of potential historic properties)

Land Use Category	P.A.	Alt. 1	Alt. 2	Alt. 3
Airfield	0	0	0	NA
Aviation Support	0	0	0	NA
Industrial	0	0	0	0
Institutional (medical/educational)	0	0	0	0
Commercial	0	0	0	0
Residential	0	0	0	0
Public facilities/recreation	2	2	2	2
Agriculture	NA	0	0	NA
Military	0	NA	NA	NA

Alt. 1 = International Wayport Alternative
Alt. 2 = Commercial Aviation Alternative
Alt. 3 = Recreation Alternative
NA = Not applicable
P.A. = Proposed Action
#/# = archaeological sites/archaeological isolate locations



EXPLANATION

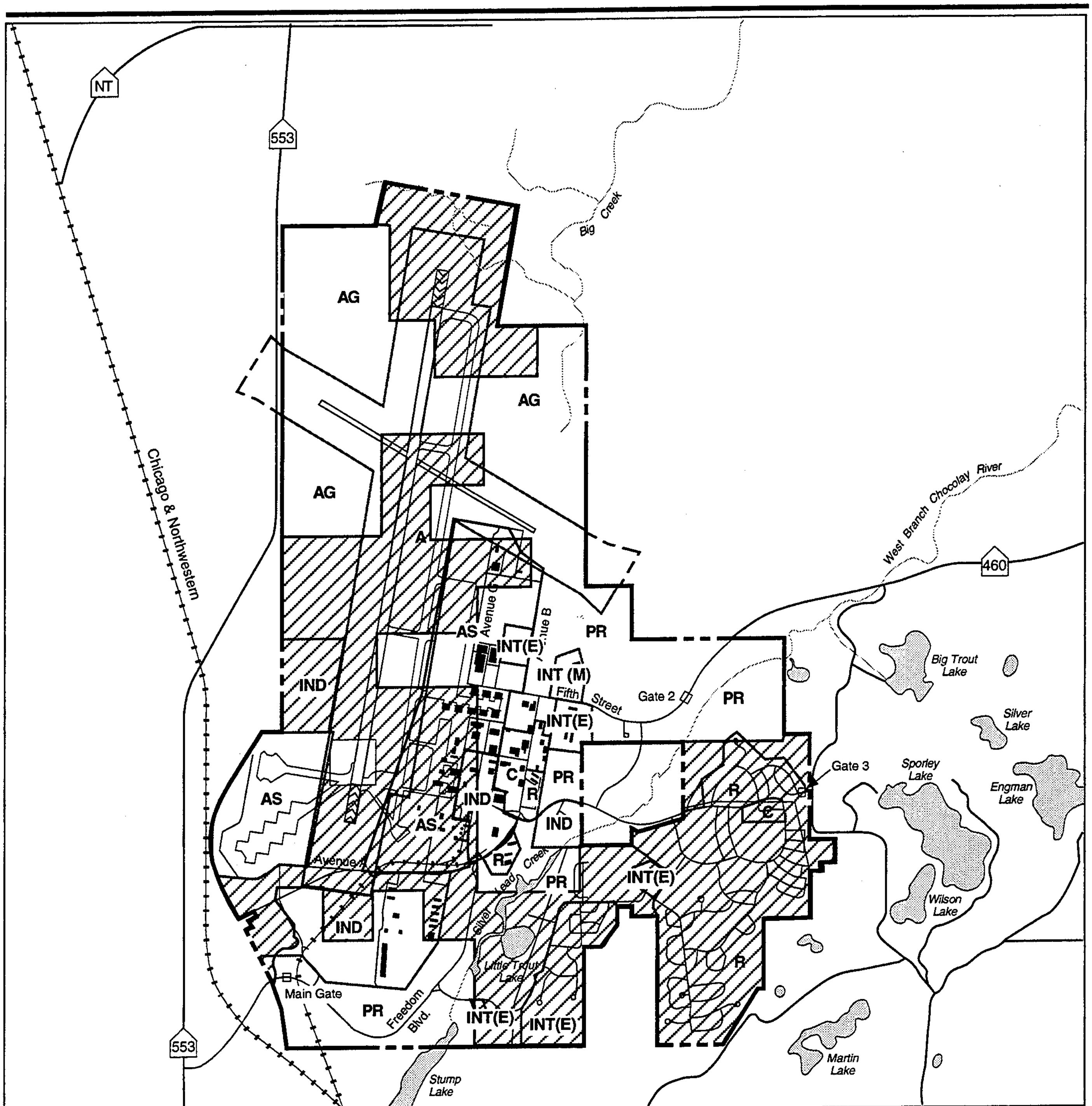
A	Airfield - 1,397 ac.	INT(E)	Institutional (Educational) - 8 ac.	AG	Agriculture*
AS	Aviation Support - 455 ac.	C	Commercial - 43 ac.	MI	Military - 193 ac.
IND	Industrial - 1,476 ac.	R	Residential - 152 ac.	(hatched)	Air Force Fee-Owned
INT (M)	Institutional (Medical) - 16 ac.	PR	Public Facilities/ Recreation - 1,183 ac.	----	Base Boundary

0 950 1900 3800 Feet

* Standard land use designation not applicable to this figure.

Land Use Parcels-Proposed Action

Figure N-1



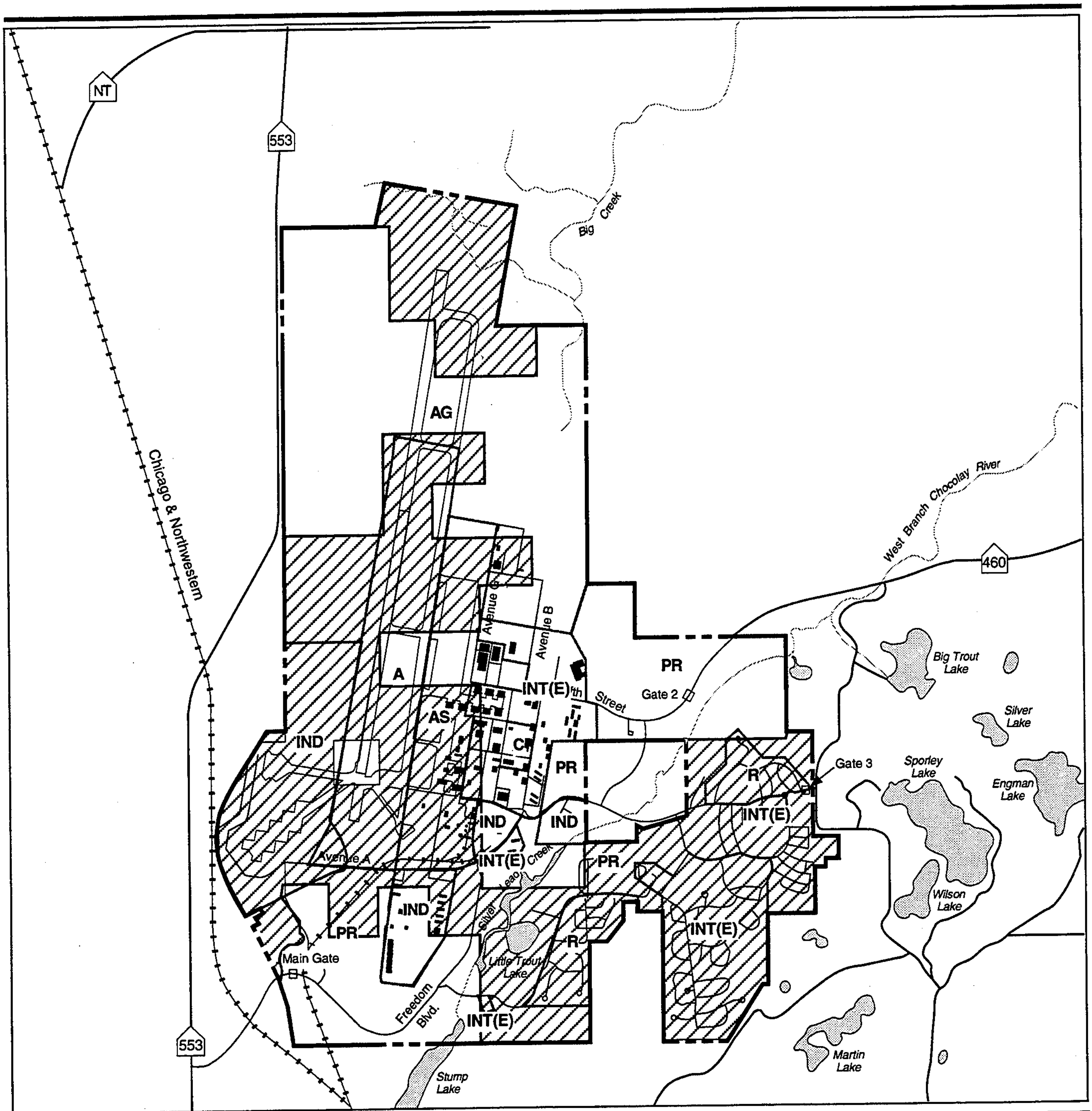
EXPLANATION

A	Airfield - 1,055 ac.	INT(E)	Institutional (Educational) - 138 ac.	AG	Agriculture - 874 ac.
AS	Aviation Support - 617 ac.	C	Commercial - 64 ac.	(hatched)	Air Force Fee-Owned
IND	Industrial - 495 ac.	R	Residential - 538 ac.	----	Base Boundary
INT (M)	Institutional (Medical) - 24 ac.	PR	Public Facilities/ Recreation - 1,118 ac.		

0 950 1900 3800 Feet

Land Use Parcels - International Wayport Alternative

Figure N-2



EXPLANATION

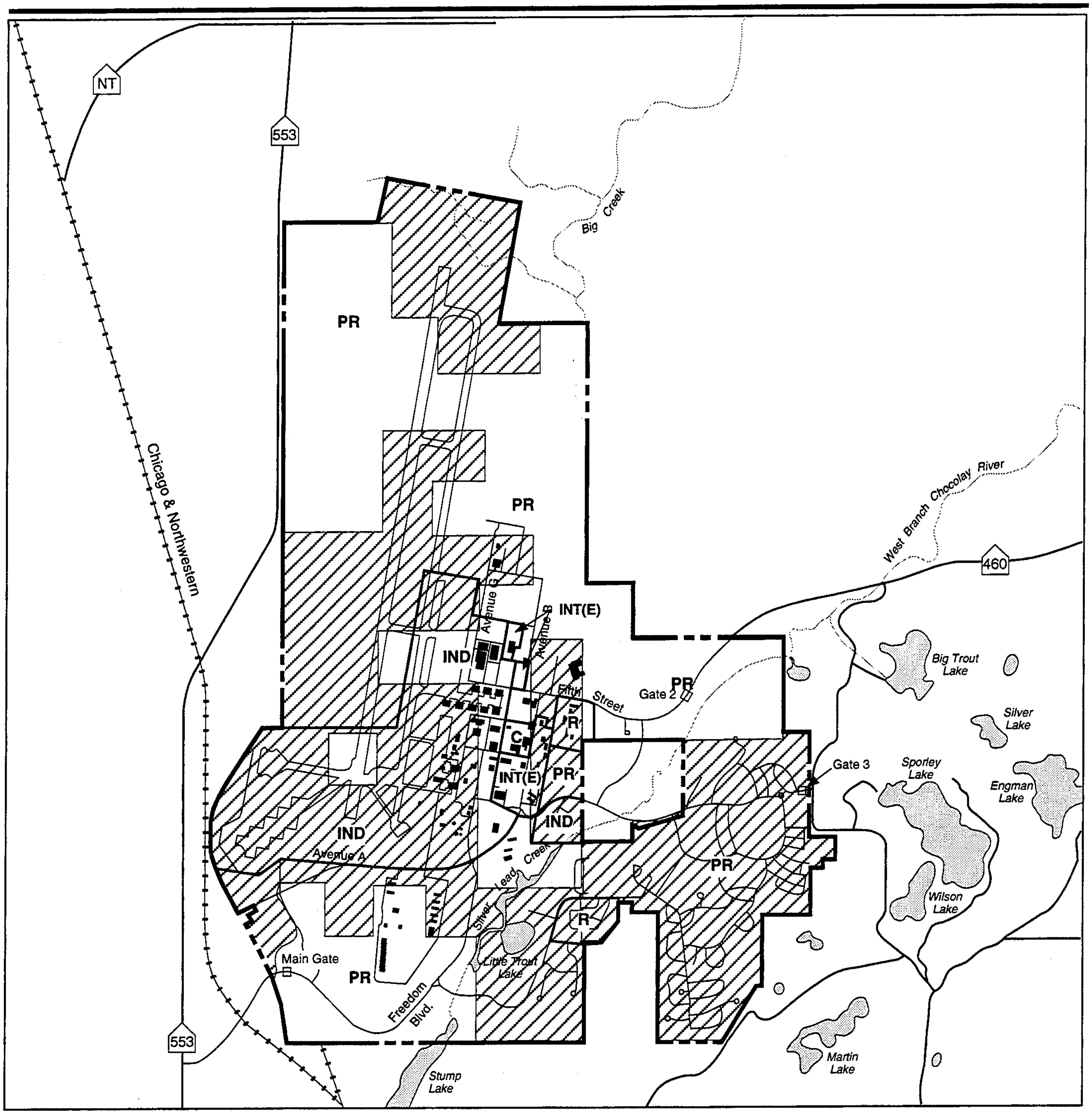
A	Airfield - 510 ac.	INT(E)	Institutional (Educational) - 546 ac.	AG	Agriculture - 1,489 ac.
AS	Aviation Support - 325 ac.	C	Commercial - 25 ac.		Air Force Fee-Owned
IND	Industrial - 494 ac.	R	Residential - 147 ac.		Base Boundary
INT (M)	Institutional (Medical) *	PR	Public Facilities/ Recreation - 1,387 ac.		

0 950 1900 3800 Feet

* Standard land use designation not applicable to this figure.

Land Use Parcels - Commercial Aviation Alternative

Figure N-3



EXPLANATION

A	Airfield *	INT(E)	Institutional (Educational) - 67 ac.	AG	Agriculture *
AS	Aviation Support *	C	Commercial - 13 ac.		Air Force Fee-Owned
IND	Industrial - 797 ac.	R	Residential - 60 ac.	----	Base Boundary
INT (M)	Institutional (Medical) *	PR	Public Facilities/ Recreation - 3,986 ac.		

0 950 1900 3800 Feet

* Standard land use designation not applicable to this figure.

Land Use Parcels-Recreation Alternative

Figure N-4